

**British Society for the
Study of Orthodontics
1947**

TRANSACTIONS
OF THE
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Study of Orthodontics

1947

HEADQUARTERS

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Portland Place, W.1.
Wallace, J. Sim, 14, Church Grove,
Hampton Wick, Middx.

CORRESPONDING MEMBERS.**Africa**

De Villiers, J. F., P.O. Box 7668,
Johannesburg, South Africa.
Maister, H. C. L., Shell House,
Greenmarket Square, Capetown.
Norriskin, J. N., 39, Jenner Chambers,
189, Jeppe Street, Johannesburg.
Williamson, M. M., Nakuru House,
P.O. Box 120, Nakuru, Kenya
Colony.

Australia.

Adamson, K. T., 111, Collins Street,
Melbourne.
Seward, J. T., 55, Collins Street,
Melbourne.
Spring, D., 71, Victoria Street,
Ballarat, Victoria.
Taylor A. Thornton, 175, Macquarie
Street, Sydney.
Wilkinson, W. S., 145, Collins Street,
Melbourne.

Belgium.

Pateas, H., Rue des Nerviens, 3,
Anvers, Belgium.
De Coster, L., Rue Archimede, 12,
Brussels, Belgium.

Burma.

Brears, O. B., 547, Merchant Street,
Rangoon.

Canada.

Franklin, G., 1414, Drummond
Street, Montreal.

Egypt.

Slama, Dr. N., 127, Queen Nazli
Avenue, Cairo.

France.

Beauregardt, A., 8, Avenue de
Camoens, Paris.

India.

Ghosh, A. S., 54, Chowringhee,
Calcutta.

Finland.

Johanson, Carin, Palkane, Birka.

Norway.

Selmer-Olsen, R., Norges Tannlage-
hogskole, Oslo.

Sweden.

Granerus, Dr. Ragner, Stortorget 1,
Nassjo.
Lundstrom, A., Stureplan. 19,
Stockholm.
Palsson, K. F., Stortorget 25,
Malmo.

U.S.A.

Goldstein, M. C., 513, Grant Building,
Atlanta, Georgia.
Gosman, S. D., 22, Northlaurel
Street, Bridgeton, New Jersey.
Sillman, J. H., 667, Madison Avenue,
New York City, N.Y.
Tessier, F. J., 314, State Street,
Albany, N.Y.

New Zealand.

Bliss, H. D., Ruatanwha Street,
Waipukurau.
Gilbert, G. H., Victoria Chambers,
Victoria Street, Christchurch.
Cook, C. C., 33, Jordan Terrace,
Mastertown.

IMPORTANT DECISIONS

(a) **Rules of the Society**

It was decided at the Meeting, on Monday, 21st July, 1947, that :-

(1) Bye-Law XII be amended to read :

“ Every person elected an Ordinary or Corresponding Member shall pay an annual subscription of two guineas in advance.”

(2) Bye-Law XIII be amended to read :

“ The first Annual Subscription shall be paid on admission and the subsequent annual subscriptions in the month of January in each year.”

(b) **Northcroft Memorial Lecture.**

The Council decided that the first Northcroft Memorial Lecture should be held on 6th October.

(c) **Transactions.**

The Dental Manufacturing Company, who founded ‘*The Dental Record*’ in 1881 has relinquished proprietorship. The Company also arranged for publication of the Society’s Transactions. The Council of the Society have now arranged for continued publication of papers in *The Dental Record* and for publication of the *Transactions* by the new proprietors of *The Dental Record*.

(d) **Meeting Day**

The day of meeting has been changed to the *Second Monday in the month commencing January, 1948.*

NOTES TO READERS OF PAPERS.

Manuscripts submitted for publication should be typed and double-spaced, setting out at the head the full title of the article with name and qualifications of the author, and sent to the Honorary Editor not later than seven days from the date of reading.

Illustrations should be sent with the manuscript and in the form of *sharp* glossy prints. Negatives and slides will not be accepted. On the reverse of each print, the name of the author and number of the illustration should be inserted.

Authors quoting extensively from published works must, before submitting the paper, obtain permission from authors or publishers in order not to infringe copyright. The same applies to previously published illustrations.

As far as is practicable papers will be published in *The Dental Record* which is the official organ of the Society. All papers read before the Society and subject to the approval of Council, will be included, together with discussion, in the yearly Transactions of the Society.

In correcting proofs authors are requested to reduce alterations to a minimum in order to save expense. No substantial alteration to text will be permitted.

While in the case of a dispute the ruling of the Honorary Editor should be regarded as final, the author may, if he feels the decision unfair, refer the matter to the Council.

The reader of a paper will be entitled to 25 reprints ; further quantities can be ordered as follows from Messrs. Saward & Co., 1 Honduras Street, London, E.C.1. (Cash with order).

	25			50			100			150		
up to 2 pp.	17	6	£1	5	0	£1	15	0	£2	2	6	
2 pp. to 4 pp.	£1	15	0	£2	2	0	£2	15	0	£3	2	6
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6 pp. to 10 pp.	£4	10	0	£6	6	0	£6	17	0	£7	17	6
10 pp. to 14 pp.	£5	0	0	£7	0	0	£8	0	0	£8	17	6

“LET US LOOK BACK.”

A Review of the Personalities, and Activities of our
Society since its inception in 1907

By

ROBERT CUTLER,
L.R.C.P, Lond, M.R.C.S., L.D.S. (Eng.)

I suppose the emotion experienced by a member nominated for the highest office of a Society such as ours must always be one of gratification, tempered possibly by the knowledge that the honour involves the preparation of an address, which by its very nature must needs differ somewhat from papers given later in the year: for his brief period of office the ideal President should be an Olympian personage, dispensing judgment fairly and firmly, eschewing violently partisan views, and avoiding the battle arena of wordy give and take, and it is therefore appropriate that his inaugural address should set the level for his future behaviour. Being myself more than averagely prone to these latter failings, the task seemed a more than usually difficult one, but as not infrequently happens in life the solution came unexpectedly, as in the course of a periodical browsing amongst my belongings—a habit that becomes more frequent as one grows older—I came across all the early minute books of the Society, finding them remarkably little damaged by time, or by the assaults of our late enemy. A first inspection proved amusing, but as I delved deeper, I came to experience a more sincere emotion, somewhat akin to that we all feel, when we look into the deed box or cabinet of some passed away friend or relative, finding as we search, old note books, a crushed flower perhaps, a ring, or a dance programme with silver-capped pencil attached by a silken cord; and the more I read and pondered the more I realised the debt we owe to those who have gone before. The present is nothing; it is a figment of time that, even as we think upon it, is already in the limbo of the past, and it is the thought of the future that seems to hold us in thrall. In the nursery we think of the time when we shall be able to read, or sit at meals with the grown-ups; as we grow older we think of having homes of our own; as married folk we think of how we shall tend our family; and then, later on, as to how we shall spend our retirement; and so on until the adventure is over at last. It is sometimes regarded as senile to think of the past, a task for the historian perhaps, but otherwise savouring of the doddering grandfather in the chimney corner, and yet I believe that if we can hear the drums of the past above the din and clamour of the present moment we are of that much greater stature and can deal more adequately with the tasks and problems that face us day by day. To-night, therefore, it is my purpose to recount to you something of the personalities in our Society since its inception in 1907, of their deliberations as recounted in the old minute books, and their contributions to our speciality as detailed in our Transactions. This, I think, may be of some interest, even to our junior members, and from it I propose to postulate an important conclusion which will be the burden of my address to-day. All the books from which I quote are available for your inspection to-night, together with

specimens and certain other matter showing the trend of world events throughout this period, the effects of which have not been without influence on our Society's career.

The first two minute books date from 1907, a year still lighted by the sunset glow of Victorian prosperity, and the one which eventually became the Council Minute Book has an initial date of 21st October, 1907. Let me read the significant opening words: "Through Mr. Northcroft's initiative a meeting of those interested in the subject of orthodontia was held at 115, Harley Street to discuss the pros and cons of the formation of a society for the Study of Orthodontia, Mr. J. H. Badcock to be President *pro tem*, and Mr. A. C. Lockett, Secretary." Mr. Hopson then proposed "That the name be the British Society for the Study of Orthodontia." It was suggested that its constitution should be similar to that of the Odontological Section of the Royal Society of Medicine, and here we have Mr. Chapman's name for the first time as he commented on this proposal. The annual subscription was fixed at one guinea, at which level it still stands to-day, albeit precariously, and there is also mention of enlisting the services of *The Dental Record* in publicising the formation of the Society, this also starting an association which has been maintained ever since. Amongst those present at this historic meeting were Messrs. Badcock, Visick and Chapman, and their continued and enthusiastic support of Society activities to this day should be an inspiration to us all.

To preserve continuity we must now turn to the other book which eventually became the General Meeting Minute Book, and here we have the first notes of a meeting held on 5th November, 1907, with Mr. J. H. Badcock in the chair, who, after explaining the object of the meeting, is reported as saying: "The idea in forming the Society was not to make it a body of specialists, but to so organise its workings as to meet the needs of the general practitioner so that the profession could meet on common ground to elucidate the problems of orthodontia." The question of affiliation was also warmly debated, but a motion was put to make it a separate body, and this was carried by a large majority, thus expressing a sentiment which has enjoyed support ever since. A full Council Meeting was then held on December 17th, 1907, called Council Meeting No. 1, when the programme for 1908 was prepared, arrangements being made for the printing of the Transactions and refreshments after the meeting. The rooms of the Medical Society in Chandos Street were chosen as the venue for the meetings, a rental of 15 guineas per year being accepted. The Society was thus thoroughly on its feet, the Council and General Meeting Minutes being thereafter kept separate in the two books to which I have referred, and it is pleasing to record that all succeeding books are safely in our care, culminating in those our good Secretary, Mr. Pringle, has under his hands tonight.

Let us therefore dip into the Council minutes first, afterwards very briefly studying some of the papers given. At the January, 1908, Council, it was decided that the exclusive right to publish papers read before the Society should be given to *The Dental Record*, an arrangement being made to share the cost of blocks and so on, and this general plan continues, insofar as papers read at the various meetings enjoy early publication in the *Record* prior to their

inclusion in the Annual Transactions, these for obvious reasons not being in general circulation until well into the following year. When papers of an original nature are given, undue delay in general publication is very undesirable, and the forethought of the first Council in making this arrangement stands us in good stead to-day. At this time a reporter was engaged by the name of Perrott, and it is of unique interest to record that two members of this Mr. Perrott's family, namely his son and daughter, still attend upon us to-day. I feel they deserve our highest praise for their technical virtuosity in converting our incoherent and disjointed mumblings into the perfect, reported English that appears in their transcripts, which, when read, must give some of our members, not excluding myself, a quite exaggerated idea of their own powers of exposition. The fee was one guinea per meeting, later raised to two guineas, and I am sure old Mr. Perrott more than earned it.

In this year, Mr. Cale Matthews suggested that branches of the Society should be formed, but apparently this was considered impracticable, and although this point was raised some twenty years later by Mr. A. L. Packham, nothing has come of it: it was also reported that the Medical Society offered to give space for the Library, then rapidly growing, and this offer was accepted, but later in the tenancy this arrangement became unsatisfactory and remained so thereafter. At the present time much greater emphasis is placed on the collection and loan of the monthly journals rather than text books, and our industrious Librarian, Mr. Gordon Taylor, has been especially active in this connection. Two committees were set up in this year, one to investigate work done on the determination of the normal arch, and the other to determine phenomena noted in cases of distal occlusion, and reports of the deliberations of these committees are still extant. In 1909 it was proposed to start a " suggestions book " or bulletin board, in, or on, which members might append notes regarding the administration of the Society for the benefit of the Council. This idea was approved, and a book allocated for this purpose, and although I remember once seeing it, I cannot now find it. I recall it had very few entries, and such as they were savoured rather of the remarks seen in the visitors' book of the typical Victorian boarding house, in which guests appended cryptic or supposedly humorous notes regarding their treatment at the hands of their erstwhile hosts. It obviously died a natural death, and without doubt suggestions are best made, in writing, direct to the Council, and I am surprised that this right is not exercised more freely than it is; there must indeed be much to criticise ranging from the pedestrian abilities of the current President to the lack of heat in the meeting hall, and only good can accrue from a free discussion of complaints. In this year (1909) Mr. Carl Schelling wrote to the Council regarding the etymological deficiencies in the word " Orthodontia ": perhaps some of you remember him as a practitioner very much of the old school, both in manners and appearance, foibles which he retained to the last, and the suggestion was typical of him. Few of us are classical scholars these days, but doubtless there were more in that far off year to realise its bastard derivation, and the purer term " Orthodontics " was quickly approved and adopted and as such it remains today. Up to this time the lantern used had been loaned by Mr. Mellersh but as often happens with borrowed articles,

this was damaged by a succession of amateur operators, so Mr. Mellersh had to be reimbursed and a new one bought for £12. In this year it is noted that B.S.S.O. papers and clinics were given at the B.D.A. annual meeting at Birmingham, and again at Liverpool early in 1910, showing that already the Society had become known outside London and that there was recognition and appreciation of those who had started to have a specialised interest in orthodontics. At this time it appears that our good Mr. Perrott was not available, and in the March minutes (1910) there is much adverse comment on the performance of another, and although it is not stated how, or why, he disgraced himself my sympathies are all with him: after discussion it was decided to give him another chance, but this also was emphatically not a success and in April, 1910, we find the elder Mr. Perrott once more at the reporter's desk. In the June minutes attention was drawn to the death of Edward VII, which necessitated cancellation of the subsequent ordinary meeting, the first notice this of the impact of outside events on the affairs of the Society, later to be followed as the years passed by events of far greater magnitude which have left their mark on us all. In October it was approved that the number of meetings be reduced from nine to seven, at which figure it has usually remained; the reduction was, I believe, a wise one, as the secretarial and general organisation work between meetings is infinitely greater than the average member might think, and as a general rule we prefer our Council members to retire gracefully at the end of their term of office rather than to expire suddenly in their Council seats as a result of gross overwork! In 1911 we find Mr. Chapman elected Secretary, with great improvement in the legibility and neatness of the minutes, his handwriting being identical with that of the signature which graces his demand notes as Treasurer today, and it might be appropriate to set on record our appreciation of his services throughout these many years, holding in turn almost every office in the Council and now continuing in the onerous and irksome task as Treasurer. It was decided to give a present to the first Secretary of the Society, and this was later done, Mr. Carl Schelling, as might have been expected, composing the inscription. A committee to study systems of classification to provide one for official adoption by the Society was also instituted, the report to form the subject for a general meeting at a later date. In 1912 it appears that the B.D.A. were also using the Medical Society's rooms, and it was agreed to allow them to use the new lantern to which I have already referred, a cryptic note being added to say that the B.S.S.O. would overlook the use—apparently unauthorised—of the lantern on previous occasions!

An attempt was made to set up a further committee to study "Etiology of Contracted Arches," but as the 1911 Committee to which I have referred was only making slow headway, the constitution of the new committee was postponed. It is clear there was an intention to have a special committee in each year to cover some designated investigation, but this proved unworkable, and the whole idea was eventually abandoned. In 1912 there was a sharp note about the publication of a report of a B.S.S.O. meeting in the *British Dental Journal* without acknowledgment to the *Record*, the asperity being no doubt influenced by the unauthorised use of

the lantern to which I have referred, and it would appear that relations between the two Societies was not over cordial at this period, though later a much more friendly and co-operative spirit grew up and has continued ever since. In 1913 mention is made of use of the epidiascope, probably the property of the Medical Society, though members were encouraged to have slides made whenever possible: it still remains questionable whether adequate presentation is possible with this instrument in spite of improvement in design and this matter was again considered quite recently by our Council. For the moment, however, our general policy is to encourage the making of slides on every possible occasion, and this facilitates the making of blocks for subsequent printing, the cost of such slides being, as a rule, borne by the Society. There was routine Council business in 1914 up till May, but the first World War had started before the autumn meetings, the one in October being cancelled, but the December one was held as usual. From the minutes there seems little hint of the struggle then raging, and little of the apprehension we were to feel twenty-five years later, and as late as February, 1915, Council business was being conducted normally, it being noted that a sum of fifty guineas was given to the Dentist War Relief Fund. Officers for 1916 were nominated as usual, though it is interesting to find the Council was visualising a reduction in the number of meetings, the Medical Society agreeing to reduce the yearly rent by five guineas for the period of hostilities. By December, 1916, however, the burden of war was making itself felt, and it was decided that Council members for 1916 should remain in office, thus setting a precedent for our own action in the recent war. The first minute book finishes with a note that the next meeting be held in November, 1917, but this was never done, the rest of the pages being blank. The second minute book opens with a formal account of the Council Meeting prior to the 1917 annual meeting, no business being transacted other than that the Council should continue in office; there is, however, mention that the minutes of the previous meeting could not be read as the old book was missing, doubtless due to some war mishap, and it seemed it needed another war to bring it to light again so that it is once more safe and sound in our archives. Affairs then remained in abeyance, formal Council Meetings only being held in November and December, 1918, and as far on as October, 1919, without any plans being made for resumption of activities, so perhaps the 1939-45 Council deserves the more credit for not only holding a regular meeting on the eve of V.E. Day itself, but also having a full programme in being for the remainder of the current year; this 1945 programme having been prepared and made ready under the rather desperate conditions late in 1944, when the enemy air activity was reaching its peak. By November, 1919, however, preparations for resumption were being tentatively considered, and a move to the headquarters of the British Dental Association, then at 23, Russell Square, was mooted, but this proposal had a very mixed reception and was eventually dropped: it had become clear, however, that the Society was outgrowing its old headquarters in Chandos Street, and the need to make a move became more insistent as time passed. In February, 1920, there is mention of a film made by the S.S. White Company on the Ribbon Arch Mechanism, presumably on standard 35mm. film,

and this was run through for the members of the Council ; they did not, however, regard it very favourably, or appropriate for official showing to the Society, though whether this was because the film was poor, or because of hidden advertising, is not disclosed. I presume, however, that this would rank as one of the early scientific instructional films, and our sub-standard film experts, like Mr. Gray or Mr. Mandiwall, would doubtless be interested to judge its quality against those they make with such skill to-day.

In 1921 there is a note that printing arrangements had become unsatisfactory, and after consideration, Messrs. Bales were chosen ; at that time the firm was called John Bale, Sons & Daniellson, old Mr. H. E. Bale being the presiding genius, and very pleasant he was as he dispensed his favours between us and the *British Dental Journal*, for whom he also worked. After Mr. Bale's death the firm went through various vicissitudes, and was later acquired by the Staples Press, but I am glad to say relations remain very cordial, and they are to be congratulated on their accuracy and knowledge of scientific nomenclature as shown in the work they do for us. In 1922 it was clear that relations with the Medical Society were becoming very strained, and the matter became acute when the late Mr. Champion's bag and overcoat were stolen from the cloak-room at Chandos Street : our Council seemed to feel that the Medical Society might be held in some measure responsible for the lack of supervision, and to that extent should share the cost of replacing the stolen articles, and a suggestion was made to them officially on these lines, but the reply sent to our Council was ingenious and can be read on page 77 of the second Council Minute Book. In this year the Council had been deliberating on the purchase of a cabinet for the housing of specimens, and after designs had been submitted and amended, the work was put in hand by Sages and completed at a cost of £60. When it was ready, Mr. Lewin Payne, the past-President, indicated it would be a gift from him, and that this had always been his intention, but that he had refrained from making his purpose known beforehand so that the Council could have an entirely free hand in its design, and this, to my mind, was a thoughtful and gracious action almost as valuable as the gift itself. A further cabinet was bequeathed to us in Mr. Lewin Payne's will, and Mr. Chapman was also the donor of a further cabinet, all three having now been renovated and safely housed in Miss Clinch's care at the Institute of Hygiene next door to our own headquarters, so that their contents can be freely available to members. In this year 1922, Mrs. Lindsay and the late Mr. R. Lindsay were elected members, and so started another association whose later benefit to the Society was to be incalculable. I do not think Mrs. Lindsay was the first lady member, but she was one of the earliest, whilst the late Mr. Robert Lindsay's appointment as Secretary to the British Dental Association was probably the reason why relations between the two organisations became infinitely more cordial on which level they have remained ever since. About this time a member wrote to the Council about the difficulty of securing adequate co-operation in orthodontic treatment from fellow members, and in the discussion a councillor, not altogether relevantly, proposed that the Council should consider the desirability of a new bye-law requiring all new members to make a contribution to the Society within a certain date of their

election. This is a thought-provoking idea, a further logical corollary being that if the said contribution was unutterably bad the member might be called upon to resign! The Council was perhaps wise in feeling that such an innovation might place too great a strain on the good nature of the monthly audience, so the matter was discreetly dropped. For some time past there had been suggestions that a prize competition be instituted, a sum of 100 guineas being visualised for the premier award, but discussion as to the conditions continued interminably, and it was not until May, 1924, that leaflets describing the scheme were circulated for discussion and approval by members: with conditions of entry settled, the examiners were chosen, but the response was disappointing, no entries being received, and although discussion continued until 1928 with regard to making the competition more attractive, nothing came of it and the matter lost interest. On reflection, I think the error lay in making the competition too formal and too restricted in scope, and that if, at any future time, the question of an award, or grant in aid, is considered, the reasons for the complete failure of this earlier venture should be very clearly held in mind. By 1930 dissatisfaction with the tenancy in Chandos Street reached a climax as a result of an intimation that no steps would be taken to help in the accommodation of cabinets, etc., in spite of our readiness to pay extra rent therefor, so the Council decided to make a move: incidentally, there had again been a suggestion that accommodation might be secured at 23, Russell Square, the then headquarters of the B.D.A., and in correspondence that passed, Mr. Lindsay made it clear the Society would be welcome, but there was perhaps a feeling in the mind of the Council that independence in thought and action might be prejudiced thereby, and once again the negotiations were dropped. This was confirmed by a directive given to the Secretary to get into touch with the Institute of Hygiene immediately, as the Second International Orthodontic Congress was then well under way, and we did not wish to be without a regular meeting place. A favourable reply was received, though only a year to year tenancy could be offered, and naturally this was regarded as a disadvantage, but the matter was brought to a head by notice to quit at Chandos Street, so the move was fixed for the following year, this taking place in May, 1931, the last entry in our second minute book being in respect of this meeting.

By the end of 1931, the shortcomings of the new accommodation were manifest, letters having been received by the Council to this effect, and it appears that it was by Mr. Samuels's introduction that we were put in touch with the Royal Society of Tropical Medicine, starting an association which has been maintained with the utmost satisfaction to the present time. Miss Wenyon, the Secretary, has at all times been most helpful, and many of those present who attend regularly will endorse my view. In our agreement space for our cabinets again proved a difficulty, but the negotiations proceeded satisfactorily, and the first meeting was held in this building on October 3rd, 1932, a seven years' lease being arranged soon after with accommodation for the cabinets in the gallery. In 1934 it was clear the Secretary was finding it difficult to undertake the preparation of the annual programme single-handed, as although a programme sub-committee had been

in existence for many years it had not been of much practical value ; it was therefore decided to ask another member of Council to act as Programme Secretary in co-operation with the General Secretary, and Miss K. C. Smyth, then on the Council, acted for some years in this capacity, being succeeded by Mr. Wilson Charles for one year, and thereafter Mrs. Lindsay, who has remained our stout helper to this day. Our action in appointing Mrs. Lindsay was a shrewd one, as none of us would ever think of refusing this gracious lady when asked for a contribution, and she has capitalised this goodwill we all feel for her to the great benefit of our Society. For some time past the question of the library had been a source of anxiety, and Miss Smyth had done her best to get it in order by discarding obsolete books of no historic value, and by bringing the journals up to date, but really suitable accommodation remained a difficulty, and in January, 1936, Mr. Northcroft raised the possibility of having a private room at the B.D.A. headquarters, now in Hill Street, as a library and reading room, and in 1937 a direct proposal was made that a room be secured as suggested without prejudice to our R.S.T.M. tenancy ; it was felt very strongly that until some such scheme was carried out the library and museum could hardly justify any serious effort spent upon it, nor could any accurate assessment be made of the demand for these facilities. The negotiations were successful and a rental of £25 per year was approved for a most excellent room, a further sum of £25 being voted for furnishings. Some time before, the question was discussed as to whether Dentists, 1921, be admitted to membership, and also whether those practising dentistry in virtue of a medical qualification be still considered eligible : the answer to the first was no, and the second yes, and the matter has never been raised again. I think the decisions were right and proper ones, as we should never neglect the academic and scientific strength of our membership. By November, 1938, the library at Hill Street was in working order, and Mr. Marsh having resigned as Curator, Miss Clinch was appointed to the Council in his stead, with charge of the models and cabinets also housed at Hill Street. Miss Clinch had very uphill work at first, but she still holds office as Curator, and as you will afterwards hear, her efforts are now having their reward. For 1939 Mr. Riddett was elected President, the start of a longer acting presidency than I am sure he ever visualised, and up till May the minutes give no hint of the impending war, but there is no subsequent entry until December, when the minutes were strangely similar to those of December, 1916 : in effect the decision was to discontinue subscriptions, and to maintain the 1939 Council in being as an executive body, with a suggestion that meetings be held in 1940 if practicable, but that no definite programme be arranged or circulated. In February, April and May, 1940, meetings were in fact held, but the situation was worsening and thereafter activities ceased. By this time it had become clear that regrettably little use had been made of the library facilities at Hill Street, and it was decided to abandon the experiment and bring the contents back to Manson House. A special Council meeting was held on the afternoon of Monday, September 9th, indicating the urgency of the situation ; a decision being made to cease activities and to terminate the library tenancy forthwith, the contents of the library and the furniture to be dispersed and

stored as quickly and as safely as possible. The enemy was, however, almost too quick for us, as on this very day one member at that meeting narrowly escaped total liquidation in a raid that occurred two hours later, and not long after our belongings at Hill Street and Manson House were damaged in further raids, the presidential badge also narrowly escaping destruction. This had been presented to the Society by Mr. Maxwell Stephens in 1928, and as I was the Council member who narrowly escaped destruction, both badge and present wearer can consider themselves fortunate ! In 1941 there was virtually no activity, with only two Council meetings and with Society life at its lowest ebb ; during the major part of the year Britain had been fighting alone, and the full import of the conflict was now apparent. For so long the average man had vaguely thought in terms of a Benevolent Power manifest in the world without accepting the logical corollary that the Power for Evil might be no less strong, and as the months passed the terrifying implications of a sovereign state deliberately allying itself with everything that was evil became clear to us all, for this proved to be no ordinary war as practised from time immemorial, with its traditional facade of pillage, shooting and destruction by warlike means. There was in addition the deliberate smashing of national cultures, the liquidation of the educated section of each community, perversion of the youthful mind, mass murder, virtual sterilisation of captive countries by segregation of the males, decimation of populations by deliberate and systematic starvation, and subjection of the conquered by threat of pain, mutilation and death. From these unspeakably evil things we were delivered by the grace of God, but it was against this dark background that the Council continued its work, and once the first shock was over it was able to increase its activity in spite of increasing difficulties as the climax came near. In 1942 some well-attended meetings were held, and a most important Council activity inaugurated ; this, in fact, arose from a motion by myself in May, 1942, in which I stressed the need for a formulation of ideas in respect of orthodontic teaching, research and treatment, indicating that post-war needs would be pressing and that no time should be lost in the preparation of reports sponsored by our most authoritative members. The Council approved this idea and eventually a special Committee was formed on which Messrs. Pilbeam, Chapman, Friel, Gray, Rix and Miss Clinch served, and this body then did an enormous amount of hard work under most difficult conditions, the fruits of their labours being reports dealing with undergraduate and post-graduate treatment, and treatment of the elementary school child. I feel these reports incorporate the most modern official views of trends in our speciality, and that they will remain useful for a long period of time. To my knowledge nothing has happened since the war to invalidate the findings and it is probable we shall find the principles enunciated being increasingly applied. At the December meeting in 1943, the death of our founder, Mr. Northcroft, was announced, this breaking the chief link with the Society's foundation, and the obituary written by Mrs. Lindsay was a fitting tribute to his memory. It is also the Council's intention to have Northcroft Memorial Lectures from time to time, so that our Founder's work will never be forgotten as long as this Society exists.

In 1944 arrangements were made to end the financial year every September so that the balance sheet could be prepared in printed form for distribution with the annual general meeting notices, and on the advice of the Honorary Auditors, Messrs. Boness and Newton, professional paid auditors were also engaged in order to lessen the technical responsibilities of their successors in future years. Arrangements were also completed for the tenancy of a ground floor room in the Institute of Hygiene for the housing of the books and cabinets, and it is hoped the convenience and proximity of this new acquisition will help all concerned. In 1945, the opening meeting was held in February and the May demonstration meeting was held on the eve of V.E.-Day, the Secretary being instructed to make fitting record of the great occasion, and on that note with memories of flags flying and cheering in the streets it is appropriate to terminate this part of the story. We had indeed been fortunate ; our Society possessions were intact, and our programme in full swing, our library and museum safely housed, our full Council still in being, albeit ready to retire, and our relations with the Royal Society of Tropical Medicine continuing on the most cordial plane, so it would seem we need not lack confidence for the future, whatever it may bring.

In planning this address, I had intended to give as much time to a review of the published work of our members over these last forty years, but this I have modified for two good reasons, first, because you have already heard me patiently and cannot bear much more, and secondly, because what is yet to be recounted is quite accessible for you in the Transactions which can be loaned from our Librarian and read at your leisure. To help you in this respect I have prepared an author's selection, so to speak, of those articles I consider infinitely worth reading and re-reading, and I have made two copies of this which are displayed with the other exhibits, so that you can take notes therefrom if you are interested, and in addition I shall content myself with a few notes and comments which may stimulate your interest still further. In the 1908 issue, Mr. J. H. Badcock gave his Presidential address, of which I read two extracts : " We wish to make our Society an arena, where can be fought out in friendly and scientific conflict, the many obscure issues with which Orthodontia bristles ; not a stage for self-advertisement or for the exhibition of those personal vanities and animosities which tend so much to obscure the light of truth." Fine words these, coming from one who was, and has always been, a modest but most highly gifted man. And again consider his tribute to Mr. Northcroft : " You may not all know it is to Mr. Northcroft and to him alone that this Society owes its inception."

Mr. Badcock, as first President of the Society, might well have been pardoned for taking to himself the power and the glory, but instead of this he hands the crown to the other, and I feel in our hearts that for this and many other gracious acts, Mr. Badcock's name will always be remembered with that of the Founder. In this year there was a short paper by Mr. Sim Wallace in which we first see the importance attached to adenoids ; he had original views about the sleeping with windows shut or open, and I will leave you to read the entertaining discussion that followed. In 1910 Mr. Wilton Thew gave a paper on some impressions of orthodontics during a short visit to America : this also merits your

perusal, and those of you who have visited America in recent years will, I believe, find many of his comments still valid, so little, if at all, does national habit and temperament change. 1911 was noteworthy in that at one meeting Mr. Badcock's expansion screw was minutely described by him, the design of which has remained virtually unchanged up to the present day ; indeed, only a few months ago an American specialist friend asked me to send him half-a-dozen as being the best obtainable of their type. Most of the expansion screws made up to that time were clumsy and not self-locking, and although the idea was not new, the application and assembly was in a class by itself. It is typical of Mr. Badcock that when some time later a member had the temerity to describe an improvement on the Badcock screw, Mr. Badcock himself said it was immeasurably better than his own ; but the fact remains, the original Badcock screw is the only one in use to-day. It is always noteworthy how an inspired design, as distinct from the discovery of a new principle, will stand on its own feet without essential modification for a quite unusual length of time, as witness the Schneider Trophy Supermarine seaplane which flashed to victory over the sunlit waters of the Solent in the early thirties, finding itself ten years later as the Spitfire fighter in the Battle of Britain, still much the same as Reginald Mitchell had planned it on his drawing board so long before. In 1912, Mr. Warwick James gave a communication on the prevention of thumb sucking, in which, as usual, everything had been tried without success, but at the mother's suggestion a V-shape cross wire was soldered to the internal expansion arch. Mr. James' comment was : " curiously enough, this succeeded," and it is obvious that it was not then clear that this habit is a sexual one, being a stimulation of a secondary erogenous zone, and any positive insulation of the area robs the child of its essential satisfaction. Mr. Paton Pollitt also brought forward a case for diagnosis : this habit of bringing cases for diagnosis and advice was common in those early years, but latterly has not been encouraged. I think this a pity, and I do not doubt our senior members would still be ready to give advice if a well-presented case was brought forward in this way by a member. Naturally, I do not think a member should casually present a pair of models for advice at a meeting, but if he is prepared to make a full presentation of relevant facts, I am sure all would benefit by discussion. In 1913 Mr. Montagu Hopson was President ; his address was typical of the man whom I remember as one of the kindest and gentlest teachers of his day. His connection with the teaching faculty at Guys was a long and notable one, and he established a tradition that has never been equalled since. In this issue there is a practical note about casting expansion plates in gold, the interesting feature being that the Badcock screw was afterwards cemented in place ; this seemed so unnecessary in view of the use of vulcanite at that time, and it would be interesting to know why this method was ever elaborated.

In 1914 there is mention of cases of partial open bite rightly diagnosed as the result of a habit of biting or sucking the tip of the tongue. Here again the nature of this habit was not rightly understood, and in the long discussion no mention was made of the virtue of the palatal barricade similar to that improvised by Mr. Baldwin in a communication two years before.

These cases of partial open bite are most interesting, and I have yet to see one that did not respond to the appropriate simple treatment already described. There was also a short report with a long discussion on the treatment of unilateral lingual occlusion: all seemed to agree treatment was difficult, a fact most of us have also experienced, the disconcerting feature being that expansion tends to make the correctly occluding side incorrect, whilst the incorrectly occluding side remains gloriously unchanged. Our approach to these cases is now more cautious, and I believe more successful, and has been discussed by myself and others in more recent years. In this year Mr. T. B. Layton read his first paper to this Society on twenty cases of mouth breathing; his style is quite recognisable, perhaps not so forthright as it became in later years, but his conclusions were eminently sane and logical, and the views he then expressed much in advance of the time. Dr. Sheldon Friel also read a paper on the angle pin and tube appliance, the forerunner of many other papers in later years, and although some of us may have been, and still may be, frightened of his austere approach to his subject matter, his combination of scientific breadth of view and technical ability is well nigh unrivalled, and few can emulate his achievements. In 1915, a case of gross inferior protrusion (true class 3) treated by a complete overlay denture was shown by Mr. Maxwell Stephens, reminding me of a completely successful similar case I handled recently, in which an all acrylic overlay denture was employed, the adaptability of this material being shown to the greatest advantage in such cases. Mr. F. B. Bull also read a paper on orthodontic teaching, visualising the scheme later to be employed at Guy's Dental School. Fifteen years later, I was able to see this scheme in operation for a period of over seven years, and although it worked well enough there was always the conflict between complete well-supervised treatment of a small number of selected cases, and compromise treatment of all and sundry, and I still feel that conflict was bad for all concerned.

In 1916, there was a paper of distinctly war-time flavour by Mr. Norman Bennett, as he then was, on orthodontic methods of treatment of fracture jaws; it was long and fully documented and should be of absorbing interest to those who have specialised in this work in the recent war. In 1919, Mr. B. Samuel read a paper on the formation of a London Orthodontic centre. To us now the social implications, of the shape of things to come, seemed to be completely overlooked in those days, and there seemed little sense of that social obligation, born perhaps of necessity, that influences so much of our discussions and planning to-day. Mr. Friel's paper on the lingual arch in this year was a perfect contribution and a study of it would save the student any amount of delving into foreign text books in which the mechanics of this appliance has been so exhaustively described. In 1921 Mr. Northcroft gave a most excellent paper on the best age for treatment in relation to retention, which could be read or re-read with advantage by any one of us to-day: it was the result of many years of experience and accurate observation, and represented the type of report our senior members should, and indeed do, give us with such benefit to-day. In 1923 the Transactions have the Society book plate on the first page, of which mention had been made in the Council minutes some time previously: it was not a very

inspiring design, and has not since been used in the Transactions, though if the block is extant it might well be preserved, and used for making "stick on" inserts in our library books, this being the practice of the B.D.A. librarian. Mr. Wilson Charles read a paper on results following the extraction of the six-year molars: the procedure is here regarded unfavourably and contrasts markedly with Wilkinson's findings published in the 1942 issue, though both contributions might have been improved, if the specific forms of irregularity or jaw abnormality for which the procedure was, or was not, suited were first outlined. In 1925 Mr. Chapman was President; his inaugural address running to fifty pages, covering investigation into the histories of twelve families, and as an example of clinical note-taking, is probably the best the Society can show.

There was also a discussion on the Mershon arch technique, a report by a Council Committee on education, a joint paper by Mr. and Mrs. Lindsay and many practical contributions, so, for connoisseurs of the Transactions, 1925 was a vintage year. In 1926 there was a paper by William Rushton, father of Dr. Martin Rushton, a member of our Council, and Professor of Dental Medicine at Guy's Hospital, entitled "Orthodontics and Common-sense," and I wonder if Mr. Russell Marsh ever realised this title had been used when he gave his two papers under this same designation: in any case his mind can be at rest, as all the papers are full of orthodontic interest and great commonsense, the forthright simplicity of the elder Rushton's style contrasting admirably with Marsh's urbane and Chestertonian wit. In 1927 there was a critical paper by Axel Lundström on "Relapse after Treatment," and his summarised conclusion, which I advise all junior members to read, surely holds good to-day. Readers of papers to our Society very often fail to summarize their conclusions at the end of their papers, which is usual practice in most scientific addresses, and this is regrettable in every way, particularly for those who may have to make a quick search for relevant matter out of a mass of material. In 1929, Mr. Northcroft was President for the second time. His paper was a practical one and took the form of a review of cases over twenty years, and there was also a perfectly delightful practical paper by Mr. H. C. Visick illustrated with excellent photographs, equalled perhaps by a joint paper he gave with Mr. Norman Gray in 1932 on "Difficulties in Fixed Appliance Work." In this year, Mr. Carl Schelling was President; his address on the origin of orthodontics being full of quotation and ancient lore, and typical of the wide knowledge of the man himself. I always remember him as an old man full of amusing eccentricities, albeit great kindness, and I often regret we do not seem to breed such characters to-day, though you might well claim that as far as signs of eccentricity are concerned, your current President has made by no means a bad start.

In 1933 Dr. Friel gave a masterly address on the use of stainless steel, and to judge by his paper last year, his confidence in this material has been justified. In 1935 Lundström gave another excellent paper on "Evidence Concerning the Nature of Bimaxillary Crowding," properly summarised at its conclusion, his command of the English language being only equalled by his mastery of the subject on which he wrote. In 1937 there was an excellent paper by Chapman on "Classifications and Prognosis," and another

by Visick and Marsh on "Failures in Orthodontic Practice." In 1938 Mrs. Lindsay was President, her inaugural address being entitled "Human Proportions," and I remember perfectly how she delivered it without a single note, so that even then she was in good training for the highest offices in the profession she was later to hold.

The papers of later years will be still fresh in your memory, and so, ladies and gentlemen, this concludes my address today. To our younger members it may have seemed over discursive, to our older ones it may have evoked the ghosts of a too-long-ago, and yet again I stress the debt we owe to the past, and the natural consequence that we in our turn must be no less mindful of our duties. As we read the injunctions laid upon us by our founder members and past Presidents, we may feel we have failed, but we have done our best, and you can be assured that those now charged with the conduct of our Society's affairs have due regard for their responsibilities, whose successful discharge is only possible with your loyal co-operation and support.

Transcending this, our paramount duty is to set on record in print our knowledge for those who come after us, for whatever our belief in the life hereafter, what is true beyond peradventure is that the skill of our hands perishes with our earthly mantle, and with it much of the knowledge accumulated so painfully over the course of years, and it is only that set on the printed record as careful and studied observation that helps the progress of the science of tomorrow.

Many of those whose activities I have recounted have already come to the dark river fringed by the cypress trees, from whose farther bank no man returns, and for each one of us here that same journey may be short or it may be long, but until then, let it be our duty to record whenever practicable our observations in this our clinical speciality. Our younger members can give their observations knowing they will have the sympathetic and courteous attention of their seniors, who recognise the freshness and originality of approach which is the hall mark of the younger mind: our seniors no less can contribute out of their wealth of accumulated experience, stimulating their contemporaries and guiding the efforts of their juniors. As we consider the problems that remain unsolved, we realise that in too many cases we still see as through a glass darkly, and the conquest of them may well depend on the work of those who have gone before. To succeeding decades our contributions may seem ignorant, pompous, and incredibly naive, and yet it may well be that some future worker, reading some such contribution, tears from it the essential clue for the successful outcome of his own investigation, and then, though you may know it not, your work will not have been in vain. Your duty and responsibility as a member of this Society is therefore clear, and if you do not fail, its further and continued success is assured.



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PRACTICAL AND THEORETICAL OBSERVATIONS ON THE NORWEGIAN SYSTEM.

A Symposium by Three Dental Surgeons

Part I.

GENERAL EXPERIENCES

by C. L. ENDICOTT, L.D.S. (Eng.)

On your Secretary's invitation to give a paper on the Norwegian system I expressed the view that it should be presented by someone who uses this system exclusively rather than by one who employs it only in selected cases. We compromised on a symposium in which Mr. Pedley and Mr. Grossmann agreed to participate. Mr. Pedley has had the widest experience with the Norwegian system of any member of the staff at the Eastman Clinic, where it was introduced by a visitor, Mr. Grossmann, who has, until recently, employed it principally. It is not the only system practised at the Clinic but it has come to fill a valuable place, particularly in the treatment of pronounced cases of post-normal conclusion.

Owing to varying success with it in other types of cases, we generally prefer other methods, recognizing that our restricted experience with this system may be an important factor in this choice. We feel, nevertheless, that a selection of appliances offers many advantages and simplifies certain problems. On the other hand we are not intolerant of those who regard the system as complete in itself.

Our experience has convinced us of its potentialities and we will endeavour to explain some of these in addition to indicating where and how the system has proved of most value to us. Our object is to concentrate on the fundamental and the practical aspects and it is hoped that those of you already familiar with the system will be patient if much of what we have to submit is elementary.

When I first saw this bulky and cumbersome appliance I was not impressed and formed an immediate decision never to have anything to do with it. A request from other members of the staff for an opportunity to try it out received my blessing, but despite their enthusiasm I remained unconvinced for some time.

When some of their cases showed definite signs of improvement later I decided to fit two or three of these plates, but did so with little confidence. My interest was finally aroused after fitting one for a little patient whose enthusiasm for it greatly surpassed my own.

Instructions to wear it at night only were regarded by her as nonsense ; she proceeded to wear it at all times, but soon found that it had to be removed during meals. When asked how she answered questions from her teacher in school she replied : "I take it out, answer the question, then pop it back in my mouth." I am pleased to report that the result has justified her confidence in the plate.

After several years of experience and observation, my main conclusion is that the Norwegian plate, used in its simplest form,

offers the most effective alternative to intermaxillary traction with fixed apparatus in the treatment of ANGLE Class II division I cases. Its advantages over traction—simplicity and convenience—are obvious, especially for those engaged in busy general practice.

I wish to point out, however, that I regard traction as an eminently satisfactory procedure which I employ more frequently than the Norwegian plate.

The ideal indication for the plate in these cases is where a very limited amount of individual tooth movement is required. Careful selection at the outset of cases of this description is advocated for those without previous knowledge of this system.

The simplest form of the appliance, on which we will concentrate, resembles an upper and a lower plate joined together. It is not unlike the retaining plates advocated by Kingsley, Angle, Hawley and others and will be more readily understood when compared with them. Kingsley recommended the use of an upper bite plate for “jumping the bite.” The Norwegian plate, therefore, can scarcely be regarded as something new, although many additions to, and modifications of it are comparatively recent. The plate does differ in that it has downward extensions on its lateral aspects of a deep anterior inclined bite plane, the object of which is to distribute the action and include in it every lower tooth.

This idea, so far as I can ascertain, was first conceived by Robin over fifty years ago (*Ref. 1*) and he describes a monobloc in an interesting treatise entitled “La Glossoptose”—the probable origin of the more recent school of cervico-facial orthopædics. Andresen began to modify this apparatus for purposes other than “jumping the bite” as early as 1911 and, with Haupl, published “The Norwegian System” in 1936 (*Ref. 2*). Since then its application has spread and articles have been published in several languages.

This appliance differs from most in that it is completely inert. After careful and well planned trimming (which will be described later) it lies loosely in the mouth and drops when the mouth is opened. As a result, the trained patient will reflexly bite it back into position. In doing so the appliance transmits the force of the muscles to the spots of contact *away* from which it is planned that the teeth shall move. Conversely, and in order that this may occur, the plate is ground free from the teeth and soft tissues at parts *towards* which movement of teeth is desired. A muscle force is thus transmitted through the planes of the apparatus to certain teeth when the patient bites the plate into position.

Kraus claims that in this way use is made of the faculty of adaptation inherent in any tissue, particularly during periods of growth or repair. Baker (*Ref. 3*) states that increased stress or strain produced either by excessive use or alterations in the mechanical conditions of the part is a well recognized cause of a local increase in bone production which is compensatory in nature.

Generally the appliance is worn only at night (after a preliminary period of day practice if necessary). Intermittent reflex muscle contractions impart, through this so-called activator, a gentle force to the teeth individually or in groups and their surrounding tissues. This muscle force is one to which the tissues are normally subjected during function and is regarded as physiological although the

direction of the muscle pull is changed. Probably no other appliance so nearly fulfils the requirements of the advocates of functional therapy. It also seems to me that the requirements of an appliance set out by Oppenheim are most nearly met by it (*Ref. 4*). The muscles of mastication, although primarily responsible for imparting this force, are by no means the only ones involved.

The Norwegian appliance also differs from most other plates in that it is made up on an accurate bite—a most important step in its construction. In Class II cases the bite is obtained with the mandible *in protrusion* so that the arches are brought into their normal medio-distal relationship. It is also left open 2 or 3 millimetres in the pre-molar area. It is this bite that provides in the finished plate the alternative to inter-maxillary traction with elastics.

In order to close the teeth comfortably into the plate the patient protrudes the lower jaw, stretching the muscles which normally retract the mandible, at the same time encouraging the muscles which protrude it to exert a forward pull intermittently. The natural reaction to the stretched muscles is to return to their state of rest. In doing so their pull backwards on the mandible and lower teeth is transmitted through the plate and its bow to the upper anterior teeth and their investing tissues. In this way the hyoid muscles in particular exert a pull backwards on the upper teeth through the plate.

On careful analysis of the musculature it will become obvious that it is probably very complex. In addition to the digastric muscles and the muscles of mastication, other groups directly concerned are those of expression and deglutition and indirectly those of respiration and posture.

In regard to the relationship between malocclusion and body posture, it will be appropriate to quote briefly here from a recent article by Dart, an anatomist who, in turn, quotes several other authorities.

“Nove, like M. B. Cohen (*Vide Strang 1943 pp. 157-158*) has pointed out that cases of malocclusion form, along with the adenoid facies and the allergies, a common ground for joint study by the physician, rhinologist and orthodontist.” (*Ref. 5.*)

Dart continues:—

“Like Stilwell (1927) and Stallard (1930) I go further and say that unless the postural syndrome of the entire body receives simultaneous attention the observation and treatment of such conditions being local, will still be, at best, partial.”

Dart considers that the mandible assumes a particular or characteristic posture in each human being; and this mandibular posture is related to, or is part of the postural set-up of that individual. I have entered briefly into this more comprehensive sphere, despite our original intentions *not* to do so. May it whet appetites for the important writings of Nove, Dart, Rix and others in this field.

My principal object, however, is to emphasize the value of a well designed plate and of this splint in particular. Its chief aim is that of intermittently placing the mandible upon the maxilla in a position of optimum occlusion. I feel that it performs this function more efficiently than other plates or planes,

In gaining some knowledge of the Norwegian system I am personally most grateful to it for stimulating my consciousness of the importance of muscle action in malocclusion. Although there are other and equally important factors, muscle tone and action should be kept prominently in mind. This is a point which I feel is frequently overlooked, particularly in connection with retention. We are prone, perhaps, to become engrossed in interesting and intricate mechanical apparatus and to forget nature's "living orthodontic appliances" as Rogers so aptly described the muscles.

The predominant feature of all bite-plates from the functional standpoint is the bite-plane. It is designed according to the operator's conception of its requirements for each case and varies from being flat to very steep. Modification of a bite-plane may become necessary during the treatment of a case, depending on the degree of over-eruption or lingual tipping of the lower incisors. This condition is described by Mershon as a deep overbite, a condition amenable to treatment. In the correction of a deep overbite he states that the only permanent change which can be brought about by the use of a bite-plate is the depression of the anterior teeth into the alveoli. Mershon shows a distinction between a deep overbite and a true closed-bite and gives a convincing explanation of why an established closed-bite cannot be opened. (*Ref. 6.*) He states that when the maxillo-mandibular muscles are in a state of equilibrium, there is a slight space between the posterior teeth so that there may be no muscular tension or strain. The insertion of a bite-plate or plane interferes with this equilibrium. The muscles then provide the active force which in turn depresses the lower anterior teeth when they occlude with the plate.

Most bite-plates provide a surface into contact with which come only the incisal edges of the lower anterior teeth. The Norwegian plate or activator on the other hand engages, in addition, the entire lingual surface of each lower tooth. Trimming is generally limited to that part of the plate overlying the incisal edges of the anterior teeth and will be explained more fully later.

A steep bite-plane facilitates and encourages forward tipping of the lower incisors. A flat bite-plane either intercepts the vertical growth of the lower incisors while permitting that of the other teeth to proceed normally within the limits permitted by the muscles or it may actually depress these anterior teeth. Between these two extremes the plane is planned or trimmed in accordance with the requirements of each case—a decision which is best reached when the plate is in the mouth.

Many modifications of, and additions to, the activator have, of course, been devised and are advocated by various authorities. They are shown in papers published at various times, for those who wish to employ the appliance in other than its simplest form, which, however, it is as well to master first. The time at our disposal has necessitated the omission of much that we would have liked to include and does not permit us to deal with these modifications except very briefly. My own experience is that the movements these modifications are intended to produce are carried out with more certainty by other appliances.

In conclusion, I wish to sound a note of caution. This appliance, if indifferently made and used, can only result in disappointment for the operator and discredit for the system.

It is far from automatic in its action.

The most accurately made appliance of any type may prove other than beneficial if it in itself is the primary concern of those employing it.

A sound fundamental knowledge of our problems and of each individual case in particular is the first requirement. This can be gained only through intensive study.

The appliance, whatever its design, is only the instrument through which that knowledge is applied.

The Norwegian system (although it probably started with an appliance) has, I believe, made a noteworthy contribution to orthodontics.

Frequently, I have felt that the appliance used in the manner and for the purpose described, provides an alternative for certain of Rogers' exercises, an alternative with which patients are more likely to persevere. As such it draws our attention to the importance and value of function and its effect on form. When, in turn, this aspect of our problem is more clearly understood, it may well enable us to make an important advance in orthodontics.

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Part II.

CONSTRUCTION

by V. G. PEDLEY, L.D.S. (Eng.)

Cases of malocclusion which respond most readily to treatment with the Norwegian plate or activator are those of ANGLE'S Class II division 1 cases requiring the force of traction or a satisfactory alternative in their ultimate correction. With the assistance of slides I will explain to you the construction of the Norwegian plate designed for this type of case (*fig. 1*).

Impressions of upper and lower are taken. The models are based and trimmed with a machine or preferably based in rubber moulds. The backs of both models must be in the same plane.

The next step is to take the so-called working bite, for which the patient pays a second visit. Before taking this, a careful study of the case is made both in profile and full face. The child's co-operation and understanding will assist in obtaining the bite in the desired occlusion.

A roll of wax of about $\frac{1}{4}$ in. in thickness is warmed and placed along the occlusal surfaces of the upper or lower teeth from molar to molar. The patient then moves the lower jaw forward until the

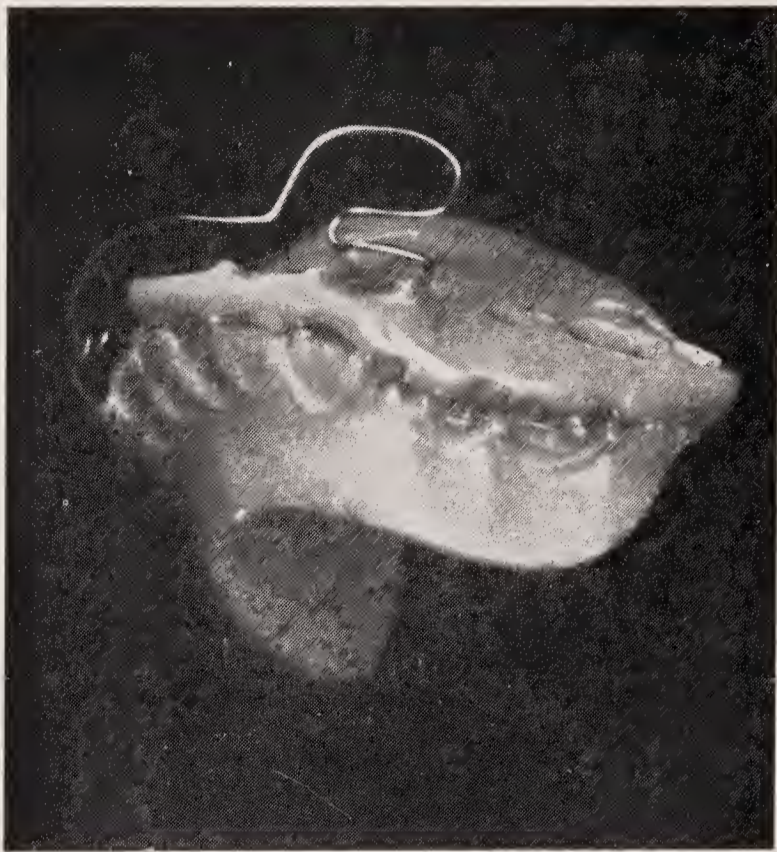


Fig. 1. Norwegian plate or Activator as designed for the treatment of Class II, Div. 1 cases. Note the mandibular wings.

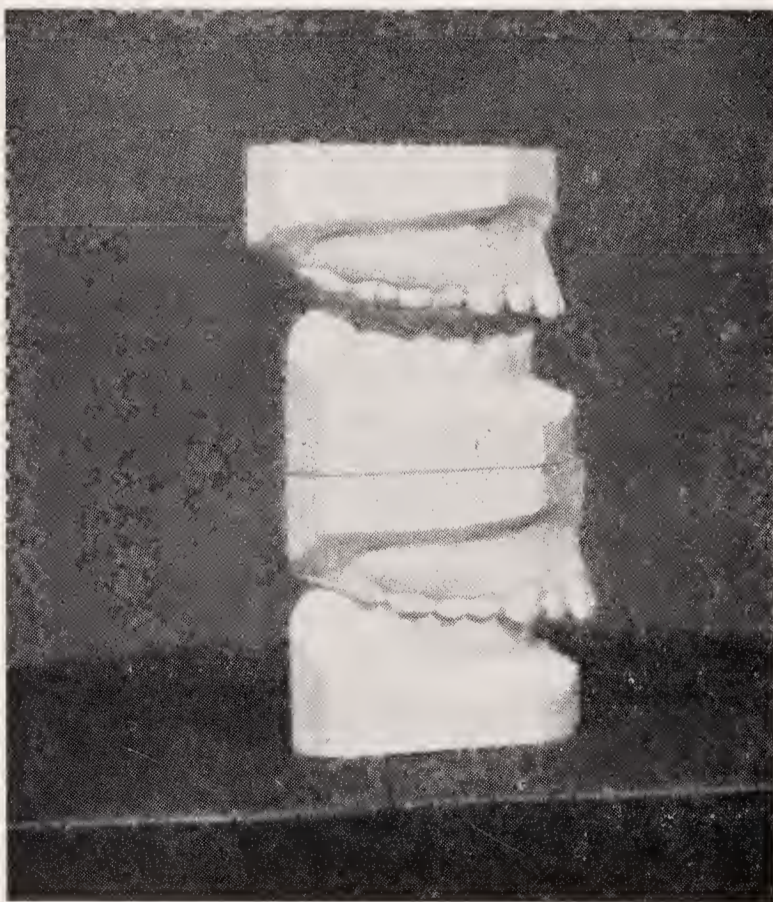


Fig. 2. Models based and trimmed. Below, backs parallel. Above, with working bite in situ, backs no longer parallel.

arches are placed in their neutral mesio-distal relationship. The patient is told to bite into the wax, holding the bite open from 2—3 mm. between the occlusal surfaces of the premolars (*fig. 2*).

The mandible must not be brought too far forward and obstruct the movement of the upper incisors, if it is intended to move them palatally, as in some Class II division 1 cases. Care must be taken to maintain the mid-line. Taking the working bite is probably the most difficult stage of all. It requires careful judgment in order to obtain the bite in the desired position.

The models with the working bite in situ are sunk into a plaster articulator. The bite is recorded with a pair of dividers and this distance is marked on the back of the plaster base for reference (*fig. 3*).

The models are now removed from the plaster articulator. The palatal and lingual gingival margins of the upper and lower casts are clearly defined with a blunt probe, so that the gingival outline is later clearly reproduced on the appliance itself (*fig. 4*). This acts as a guide when trimming the plate.

The labial arch wire for Angle's Class II division 1 is made up in 0.7 or 0.8 mm. stainless steel wire. It is designed to lie against the labial surfaces of the upper incisor teeth (*figs. 5 and 6*). The hook around the canines is designed to prevent medial movement but to allow for labial and distal movement. These hooks are not suited to every type of case. Alternatively a simple loop is made.

A sheet of wax is warmed and pressed against the occlusal and palatal surfaces of the upper teeth, also covering the hard palate to the extent that an upper denture would normally cover. The arch wire is warmed and placed into correct position against the incisor teeth (*fig. 7*).

Another sheet of warmed wax is also pressed against the occlusal and lingual surfaces of the lower teeth and the lingual aspect of the alveolar process—again covering an area a lower denture would cover.

A harder wax (rational mounting wax) is now taken which is softened and pressed in sections against the palatal and lingual surfaces of the teeth (both upper and lower) with the end of a wax knife, pressing the sheet wax into the clearly defined gingival margin.

The models are now articulated in the plaster base, with a roll of warmed wax placed between them. They are pressed together and the bite checked with the dividers (*fig. 8*).

Here I should like to mention that a Dr. Bjork, whom I met in Sweden, arranged a third visit at this stage. The wax extending over the occlusal surfaces of the teeth was warmed, and the patient made to occlude the teeth into the waxed-up plate. In doing this, he stated that he was able to avoid certain slight adjustments which he found were sometimes necessary when inserting the finished appliance in the mouth for the first time. The waxed-up plate was then replaced on the models, which were again assembled in the plaster articulator. The bite was finally checked with the dividers.

The models are now taken from the articulator. The upper model is removed, leaving the waxed-up activator on the lower

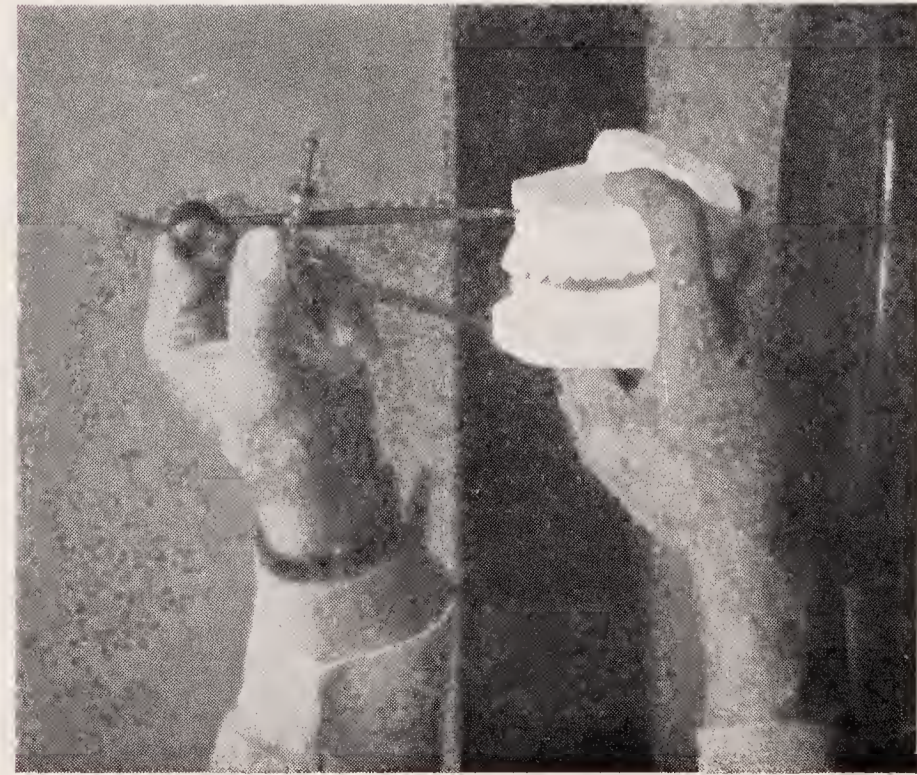


Fig. 3. Plaster articulator. The bite is recorded with a pair of dividers. This distance marked on back of plaster base.

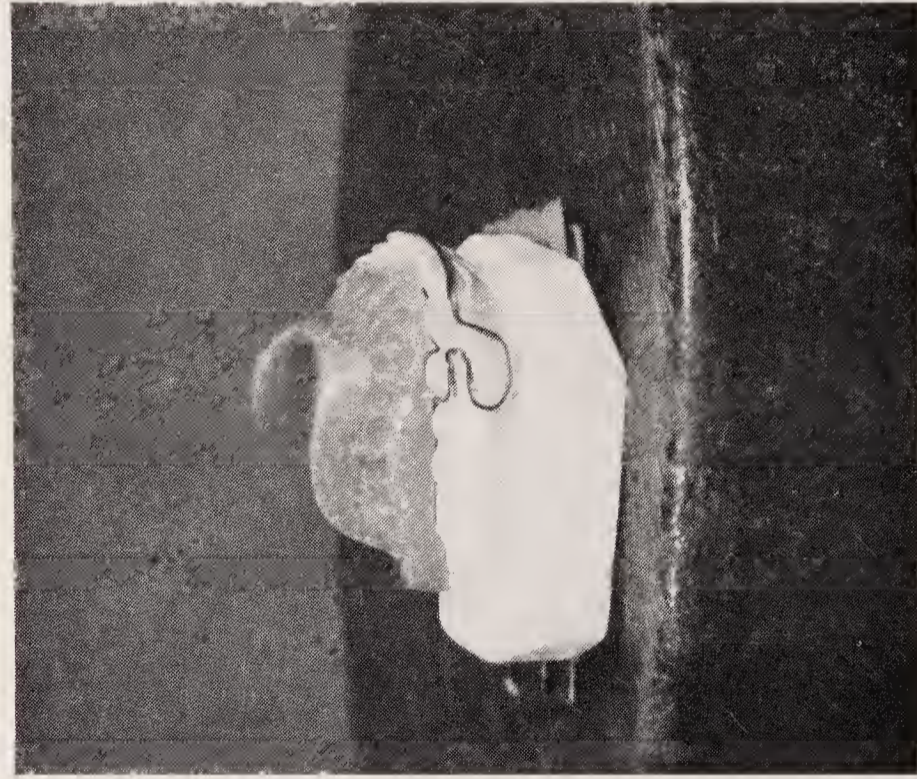


Fig. 4. Gingival outline clearly reproduced on the appliance itself.



Fig. 5. Labial arch wire is made up in .7 or .8 m/m. stainless steel wire. First stage, canine hook.

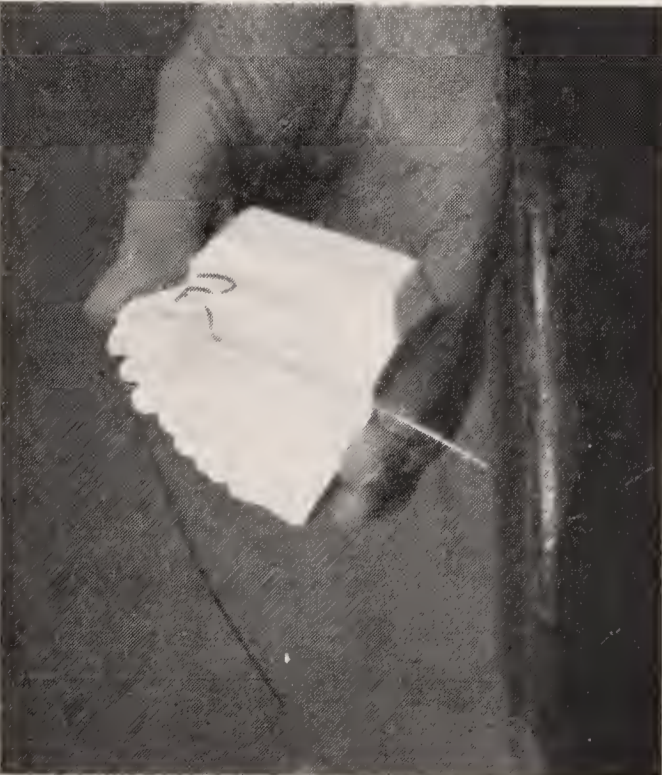


Fig. 6. Second stage, canine hook.



Fig. 7. The arch wire is warmed and placed in position against the incisors. Also showing wax extending beyond the lingual half of the occlusal surfaces of cheek teeth removed.

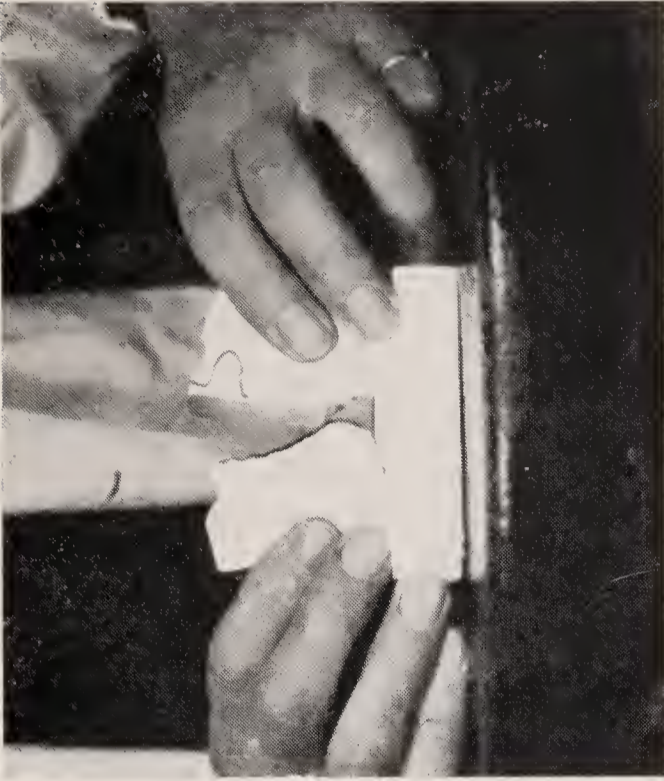


Fig. 8. Models articulated in plaster base, with a roll of warmed wax placed between them. They are now pressed together and checked with dividers.

model. All the wax extending beyond the lingual half of the occlusal surfaces of the cheek teeth is removed with a sharp wax knife and the palatal surfaces smoothed off (*see fig. 7*).

The plate is now processed and finally polished. The patient is instructed to wear the plate all night and every night and an hour or so during the day, whilst reading or doing homework.

The appliance is loosely fitting and will drop when the mouth is opened. It is positioned in the mouth by the actions of sucking and swallowing and is held there by the accompanying thrust of the lower jaw and the teeth into the plate, which is thus activated. There is a backward pull of the lower jaw against the plate. The plate in turn prevents a return of the jaw in the habitual rest position, the force created acting as an alternative to intermaxillary traction. With repeated activation the muscles concerned become permanently strengthened.

The plate is trimmed in such a way, that when activated, it is made to touch only certain spots. It is to these spots of contact that the muscle stresses are directed, as you will see in the following slides. (*fig. 9*).

In ANGLE'S Class II division 1, the plate is trimmed in the upper distal to each tooth, leaving points of contact medially.

In the lower the material is trimmed away medially with points of contact distal to each tooth. In order to obtain expansion, if required, as vertical growth proceeds, this trimming is tapered outward and not parallel with the long axis of the tooth. This creates an inclined plane along which each tooth will be deflected buccally, as eruption proceeds (*fig. 10*).

The labial arch wire touches the labial surfaces of the incisors. If the material contacting the palatal surfaces of these teeth is trimmed away every time the plate is activated, these teeth will receive a stimulus to move them palatally. The labial arch wire is no longer passive but active.

In the lower the plate is trimmed away from the incisal edges of the incisor teeth. The pressure brought to bear against the lingual surfaces of the lower incisors by the pull of the mandible against the plate will tend to move these teeth in a forward direction (*fig. 11*).

The chief aim of the activator is to gain functional balance, stimulate and strengthen the muscles and so establish stability. In cases where individual tooth movement or expansion requires a stronger force than the Norwegian plate can give, it is necessary to introduce some active force such as gutta percha or springs. The gutta percha is added to the plate in the following way. Cut into the plate with an inverted cone and pack gutta percha into the undercut. More gutta percha is added from time to time.

Small springs can also be incorporated in the plate for individual tooth movement.

In Sweden, I found that Lundström, among others, is introducing Coffin springs into the plate (*fig. 12*). Haupl, of Vienna, on the other hand, employs Tishler screws. I have not used the latter but am trying out the Coffin springs.

So far, I have not mentioned the treatment with the Norwegian plate of Class II division 2 cases or Class III cases.

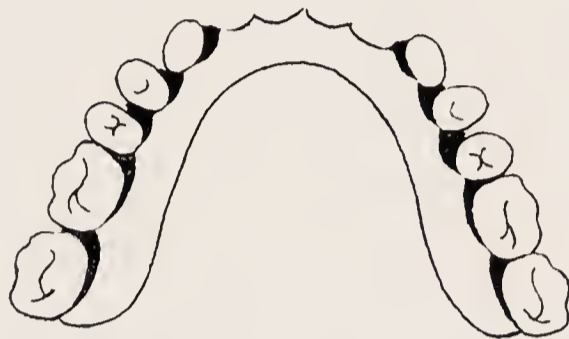
In Class II division 2 the labial arch wire is designed to stand away from the upper centrals (*fig. 13*). This holds the lip away from these teeth allowing freedom for forward movement. Hooks

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UPPER OCCLUSAL.
PLATE TRIMMED DISTALLY.



Blacked out areas represent parts trimmed away

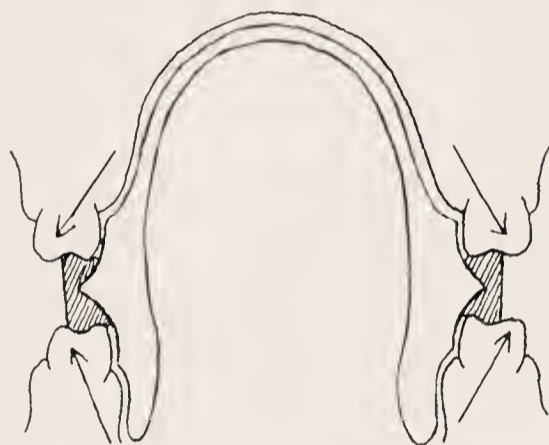


LOWER OCCLUSAL
PLATE TRIMMED MESIALLY
Blacked out areas represent parts trimmed away

Fig. 9.

DISTAL
BUCCAL
DIRECTION

MESIAL
BUCCAL
DIRECTION



Shaded part represents material trimmed away

Fig. 10.



GUTTA PERCHA INTRODUCED
AS AN ADDED ACTIVE FORCE.

Fig. 11.



Fig. 12. Coffin spring with plate divided through centre.



Fig. 13. For the treatment of Class II, Div. 2 cases. Arch wire designed to stand away from upper centrals. Hooks around the laterals.

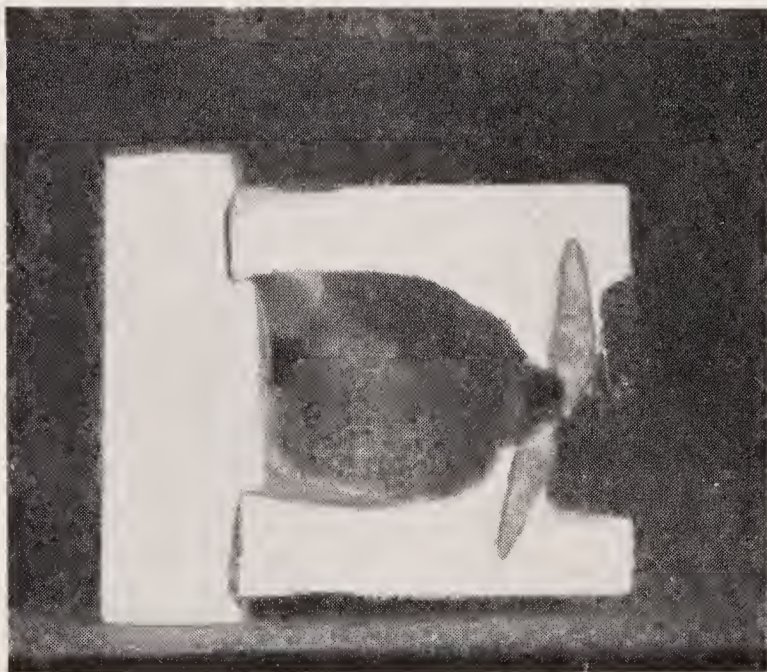


Fig. 14. Cross section of Norwegin plate in treatment of Class Div. 2 cases, showing Gutta Percha added palatally to the two centrals.

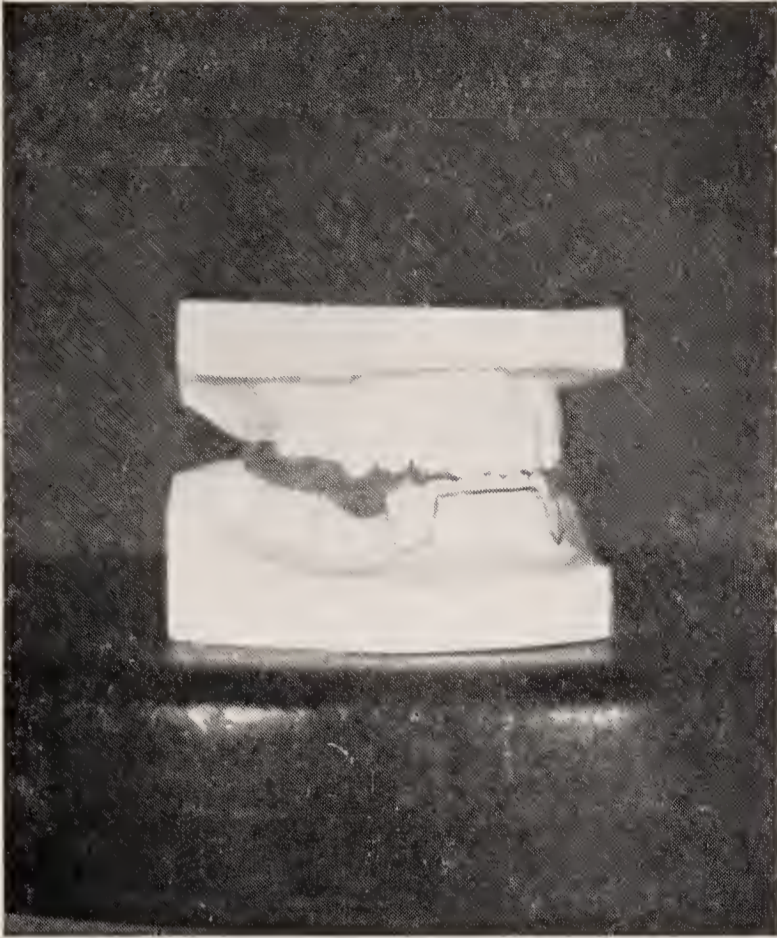


Fig. 15. For treatment of Class III cases. Labial arch wire lined up to lower incisors, instead of upper incisors as in Class II cases.

are made around the laterals and can be adjusted to move these teeth distally. Gutta percha or a spring is added to the plate palatally to the two centrals, as an active force to move these teeth labially (*fig. 14*). I have not treated this type of case with the Norwegian plate and I do not feel in a position to offer an opinion.* In true Class III cases, the chief difficulty arises because of the inability of the patient to move his mandible distally, thus preventing a satisfactory working bite to be taken. Only in the so-called symptomatic cases has any success been achieved. The working bite is taken with the mandible brought backwards as far as possible, with the upper and lower incisors meeting edge to edge. The labial arch wire is lined up to touch the labial surfaces of the lower incisors instead of the upper. Gutta percha is added to the plate behind the upper incisors in order to move them forward. To avoid the appliance from tipping, the plate is not trimmed at all in the molar region. This method, I found, was being employed in Sweden (*fig. 15*).

Finally, I should like to say that this appliance has certain attributes.

It is easily kept clean.

It is worn only at night and does not interfere with speech or mastication.

It does not induce caries or parodontal disease.

Frequent observation and adjustment is not needed and patients can be seen at intervals of from two to three months—a decided advantage in the treatment of children who are at boarding school or who live at a considerable distance.

*Since this article was first written cases of Class II, Div. 2, under treatment are responding successfully to the Norwegian plate.

Part III.

RESEARCH

by W. GROSSMANN, M.D. (Prague), L.D.S. (Eng.)

Mr. Endicott and Mr. Pedley have given you their views and experiences with the Norwegian Plate. I do not want to enlarge on the subject of clinical use of functional jaw orthopædics, but I should like to give you a short summary of clinical research and animal experiments done on this subject by Haupl and his School.

Introducing this subject, I should like to recapitulate that the aim of functional jaw orthopædics is to achieve the tissue changes necessary during an orthodontic treatment by functional mechanical stimuli. This aim, therefore, necessitates that the construction of the Norwegian plate fulfils certain principles. The appliance must be a completely passive one and fit loosely in the mouth. This excludes the use of elastic forces, such as springs, elastic, screws. The appliance must be loose so that muscle action can move it into contact, at the selected points, with the teeth and gums. Muscle forces so transmitted, will then be responsible for the tissue changes we need and aim at in an orthodontic treatment.

These are our aims, but functional jaw orthopaedics has not yet, in my opinion, been developed to an extent that will enable us to treat every case on these ideal lines.

A certain number of cases, I feel, require active forces.

That a direct relationship exists between functional mechanical stresses and bone structure, has been known for a long time and evidence has been submitted by Roux, Wolff, and Pommer. If the functional mechanical stresses are changed the bone structure is modified accordingly.

While these facts are generally agreed, the exact way in which the bone changes, is not yet known.

To examine in detail the tissue reactions under changed mechanical stresses, Haupl and his School decided to carry out investigations.

It was decided to collect the material for these histological examinations from cases which were treated with the Norwegian plate, without any attached active forces, springs or screws, and to investigate two problems—

1. Changes occurring in teeth and surrounding structures.
2. Changes in the temporo-mandibular joint.

While the examination on the T.M. joint could only be done in animal experiments, it was considered of little value to try and investigate tooth movement in animals. It was, therefore, agreed to obtain the material from children who needed extractions as part of their orthodontic therapy. I should like to add here, that Andreson and Haupl do not advocate frequent extractions but they feel that the amount of bone changes they can anticipate during the movement of teeth into a new position, has limitations. If we overstep this limit, we run the risk of a relapse and therefore it is advisable to obtain an *individual optimal occlusion* rather than a normal occlusion as advocated by Angle and his School.

The cases from which the material was obtained were those with considerable compression in the upper canine and pre-molar regions where extractions of the 4 were indicated.

Eleven cases were treated with a Norwegian plate for different periods and then the first premolars, together with their surrounding bony structure, removed.

The material was obtained by the following method: after the child had worn the appliance for a certain time, under local anæsthesia a buccal flap was cut exposing the outer plate of the alveolar process over the 3—5 region. On the palatal aspect a triangular flap was dissected, consisting of a vertical incision in the region of the lateral incisor and a horizontal one along the gum margin. This flap was carefully lifted so as not to injure the palatal vessels and nerves.

The buccal flap was then retracted and with small rosehead burs, holes were made to both sides of the roots of the first premolar, above, medial and lateral to the apex, and the alveolar process was pierced with long fissure burs. A thin Gigli-saw was then inserted and the 4 removed with its surrounding hard structures in one block, following down the previously made bur holes.

The soft tissue flaps were then allowed to fall together and sutured. A drain was left for a few days and kept in position by a figure "8" ligature from the canine to the 5. The space thus created was closed by tooth movements during the later stage of the orthodontic treatment.

This operation may sound dangerous and complicated but if radiographs are previously studied and all possible care taken, it is quick, simple and not so involved as it may seem.

In the cases done at Prague, no adjoining teeth were injured nor the maxillary sinus opened. All cases healed within a fortnight without any complications.

Time does not permit me to go into details of each case. I shall, therefore, give a short survey of two cases investigated and follow up with a short summary of the findings.

Case 1. The specimen was obtained from a child aged 12½. The child had to have the upper first pre-molars removed and was fitted with a Norwegian plate which it wore for three nights. After this time, the upper premolars were removed together with the surrounding tissues. During the first three nights, the plate was worn without complaint, clinically no tooth movement was visible or expected.

Fig. 1. Shows section of the specimen obtained. Some bone round the apex of the buccal root is missing in the specimen.

The periodontal space on the buccal side appears broader in its marginal part than the corresponding space at the palatal side.

Fig. 2. Shows the palatal aspect of the parodontal membrane. Fibroblasts and fibrocytes can be seen. Fibrocytes have a dense nucleus, fibroclasts a loose nuclear structure. On the bone surface we see a new layer of bone and osteoblast and on the surface of the cement no visible change.



Fig. 1.

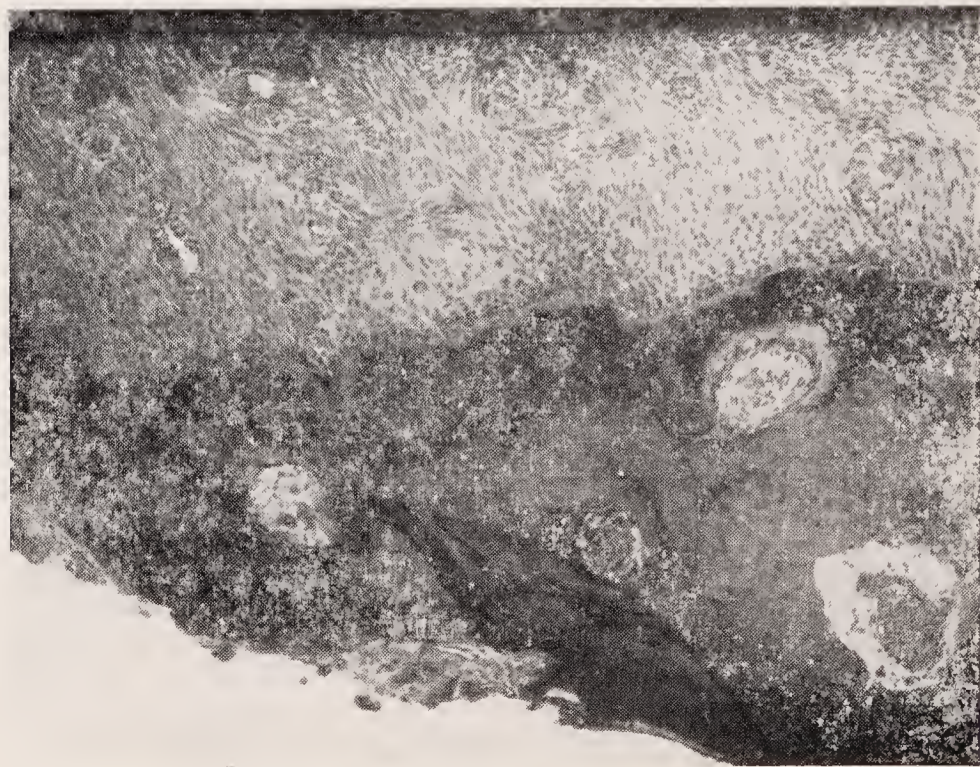


Fig. 2



Fig. 3

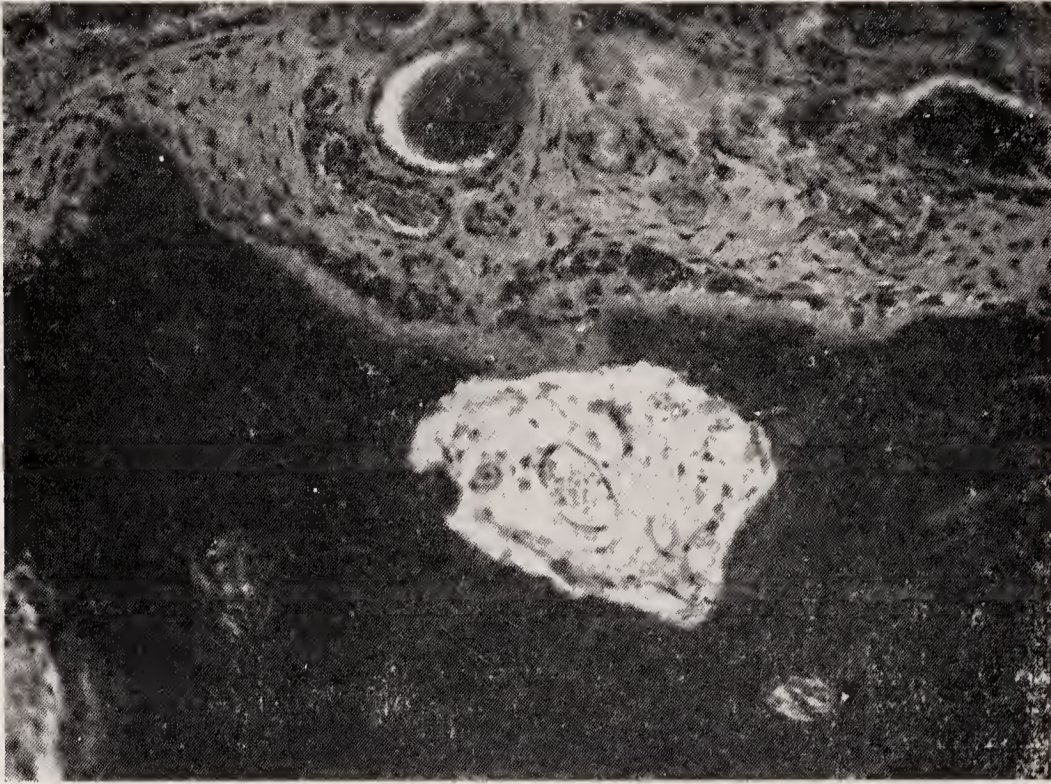


Fig. 4



Fig. 7



Fig. 6

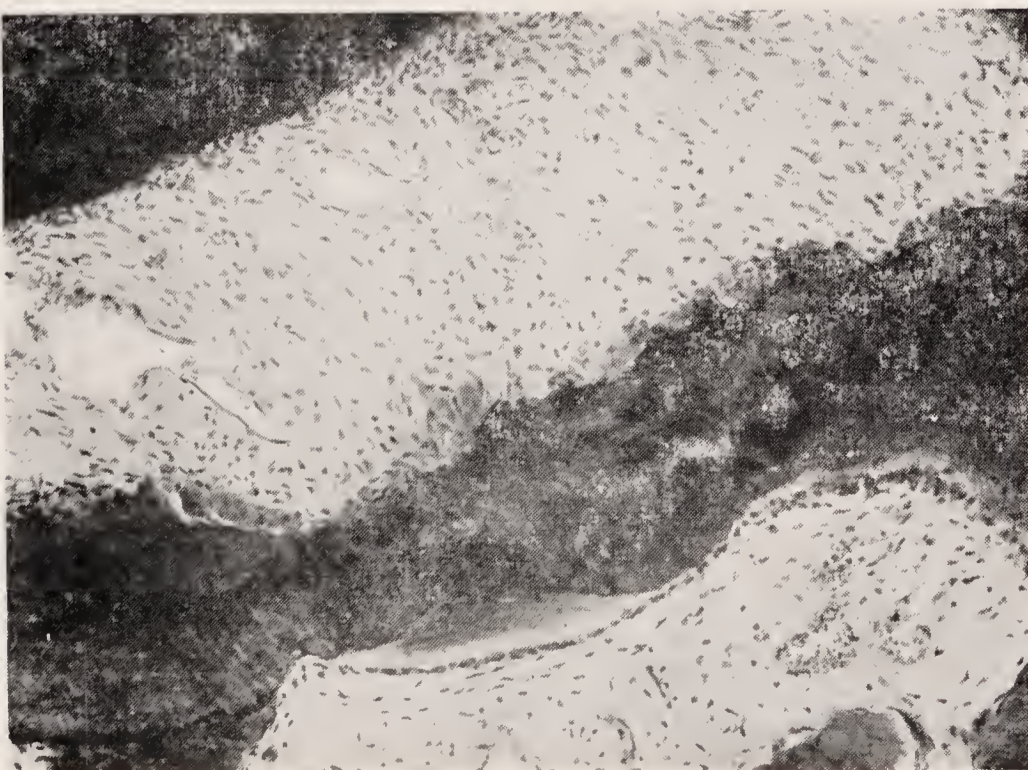


Fig. 5

Fig. 3. Shows the parodontal membrane on the buccal side, again rich in cells. The vessels are hyperæmic. The bone surface shows a new layer of bone and osteoblasts. It would have been in this area where resorption could have been expected. Large magnification already shows some osteoclasts.

Fig. 4. Shows osteoclasts as well as considerable hyperæmia. One can also see a conglomeration of osteoblasts, which are about to take on osteoclastic function. Mononuclear osteoclasts can be observed starting bone resorption. Within the bone marrow there are already hyperæmic vessels.

Fig. 5. Demonstrates the parodontal membrane and alveolar bone within the interradicular space. On one side we can see bone resorption (mono- and multi-nuclear osteoclasts), on the opposite side new bone formation. (Osteoblasts.) This appearance corresponds to the tooth movement taking place.

Fig. 6. The next case shown was treated for seven nights. Again the first premolar was removed, together with its surrounding structures. This tooth, too, was moved in a buccal direction with the help of a Norwegian plate. The slide shows the parodontal membrane compressed on the buccal side, and stretched on the palatal side.

Fig. 7. Shows the parodontal membrane and alveolar bone on the palatal side. An osteoblast layer can be seen, as well as a layer of newly formed bone.

Fig. 8. Within the bone marrow, hyperæmia can be noticed. the buccal side looks quite different. While the parodontal membrane is rich in cells, the bone surface shows many mono- and multinuclear osteoclasts. Towards the bone marrow side, newly formed bone and a layer of osteoblast can be seen. This means the alveolar plate shows transformation resulting from the buccal move of the tooth.

I had the intention to show you slides of most of the twelve cases, so as to be able to develop the histological changes during orthodontic treatment with the Norwegian plate after wearing the appliances from three nights to 36 weeks. Time does not allow me to do so now and I shall therefore give you a very short summary of those findings—

1. The first obvious changes are the appearances of many fibroblasts within the periodontal membrane, which can be seen after three nights' use of the Norwegian plate.

2. Appearance of osteoblasts after three nights, along the alveolar bone of the tooth socket.

3. Only very few cementoblasts can be seen after three nights. If seen, they are mostly round the inter-radicular space near the entrance to the socket. They become more numerous after an appliance has been worn for a week and still more pronounced after three weeks. This means that those cells react more slowly to forces.

4. The bone marrow of the alveolar bone adjoining the socket shows very little change after three nights' treatment. After one week, they become more obvious and after three weeks definite changes can be seen. We see the appearance of multiple fibroblasts, slight œdema, hyperæmia, new bone formation and resorption,



Fig. 8

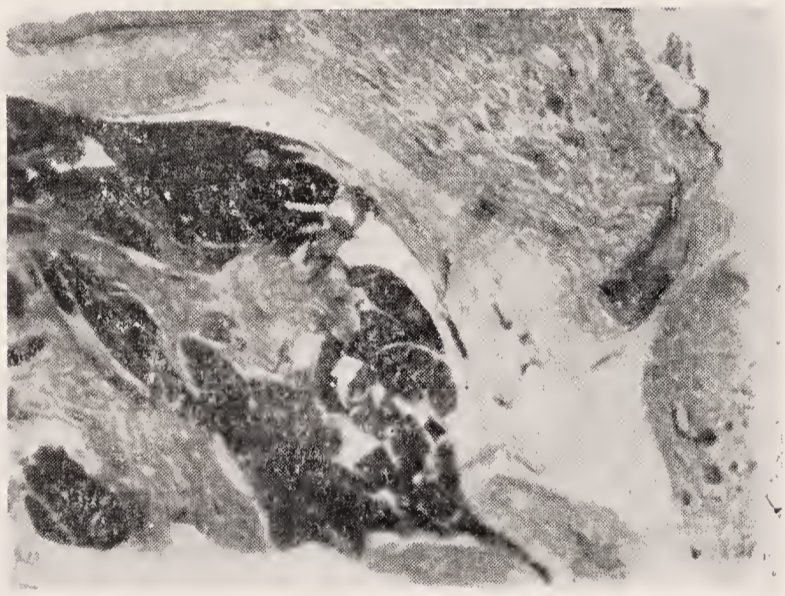


Fig. 9



Fig. 10

The newly formed bone very often still shows the outlines of incorporated periodontal fibres.

On the whole, we notice a hypertrophic development of the paradentium. This means that the tooth is, on termination of the treatment, in an increased paradentium.

5. The appearance of osteoblasts along the whole length of the alveolar socket allows us to assume that the bodily movement of this tooth is possible.

6. Osteoclasts, mono- and multi-nuclear, are responsible for the bone resorption. Isolated osteoclasts can be seen in the specimen of the cases treated for three nights. They become more numerous after a week and still more numerous after three weeks. In the area and near the osteoclasts, we see hyperæmic vessels and new tissue formation. Haupl considers that the functional mechanical stresses transmitted by the activator, produce tissue formation and a hyperæmia, which leads secondarily to osteoclast activities. Furthermore, slight compression of the periodontal space, produced by the activator, will also contribute to resorption.

7. Resorption on the surface of the root was seen in only one case, where a Coffin-spring was used. The amount of resorption was small and did not appear more extensively as it is seen at the time of eruption.

8. Traumatic pathological changes due to the Norwegian appliances could not be detected in the cases examined.

Oppenheim states that biological tooth movement means that bone resorption is not faster than tooth movement. The histological findings of cases treated with the activators, show that tissue and bone transformation during functional orthopædic treatment comes, perhaps, nearer to this aim than any other method.

As Mr. Endicott has said before, the activator is an excellent method of bringing the mandible forward. How is this achieved? Do we establish a bite of convenience or some temporo-mandibular joint changes?

To investigate this question, experiments were done on old world monkeys. The case which I am reporting to you is that of a baboon which was fitted with a Norwegian plate, thus bringing the mandible into a mesio-occlusion. The animal was given Veronal in sweetened milk, three hours previous to the commencement of the experiment. The sleep induced was light and muscle reflexes remained little changed. The appliance was then inserted and left for one-and-a-half to two hours. It may be interesting to mention that the activator had to have holes to allow for additional mouth-breathing as nasal breathing proved insufficient. After ten days, the baboon became used to the procedure and the appliance could be inserted and was worn with reduced premedication. After three weeks' use, the mandible remained in mesio-occlusion for approximately 12 hours. After eight weeks the animal was so used to the appliance that it could be inserted and was worn without premedication.

After 11 weeks, the baboon was killed by an overdose of Pentothal. The post-mortem showed pulmonary tuberculosis and signs of rickets. Both T.M. joints were excised and histologically examined after preparation by Bock's method,

The specimens showed new bone deposition on the distal part of the condyles. To a far smaller extent, new uncalcified bone could be seen on the mesial part of the condyle. The articular fossa of the joint showed also new bone formation from osteoblasts from the Kambrium layer between the fibrous surface and the deeper bone layer. This new bone was only partly calcified and showed presence of multiple osteoblasts.

These findings are similar to those published by Breitner in his examination on T.M. joint changes.

New bone formation could also be seen in the area of muscle insertion along the ascending ramus, and in the angle region.

I should like to add that Haupl thought that considering the short time of treatment, the rather extensive changes seen, may be due to the fact that the bone of an animal showing signs of rickets responds quicker and more extensively to mechanical stresses.

Fig. 9. A cross section of the specimen of the left T.M. joint. Part of the parotid glands are still attached to the specimen.

Fig. 10. Shows a cut through the joint space. The articular fossa is covered by fibrous tissue, beneath which we can see new bone deposition. The disc is of fibrous structure. The condyle is covered by a cartilaginous layer.

Summing up, I should like to say that time prevents me from going into details. For those of you who are interested in the histological findings, I shall be pleased to make the original slides available.

To the practitioner who likes to use the Norwegian plate, a word of warning. The activator may appear simple to construct and to use ; let me assure you it is more complicated than it may sound in the beginning and must not be used without exact knowledge of its construction and filing out.

Sometimes I am asked, why do you think it is inadvisable to place it in the hands of the general practitioner, as a cheap, simple form of orthodontic appliance ? The answer is that the Norwegian plate is only an additional part of orthodontic therapy and you must be able to judge from experience when to use it. It needs to be learned as thoroughly as any other method. It is true you cannot do the same damage to the paradentium as with active appliances but you may, if using it incorrectly, lose valuable time. You may, as I have shown you on animal experiments, bring about temporo-mandibular joint changes which may prove, putting it mildly, rather troublesome.

Many of you will say that the results we have shown could have been obtained by any other method, perhaps even quicker. To those, I have to say you may be right.

Haupl and his School have never claimed to have achieved results which other methods could not bring about. What has been claimed is that functional jaw orthopædics achieves its results by forces more biological and therefore less damaging. The idea of functional orthopædics is not new, but new is the scope to which Andresen and Haupl have developed it. We do not pretend that we can treat every case with it, we still have to use, in certain cases, active forces. We do not try to show the advantages of functional jaw orthopædics only, we have its present limitations continuously

in mind and we are determined to overcome them, as we feel that functional jaw orthopædics is, medically speaking, the treatment on the right line.

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DISCUSSION.

Mr. Norman Gray, in thanking the authors for their papers, said that the very large attendance at the meeting showed the interest that was taken in the Norwegian appliance. Like Mr. Endicott, when he first saw the appliance he had not been impressed by it, but he had then met Mr. Nove, who was using it and obtaining some extremely interesting results with it. He had now had an opportunity of using it in his clinic on the south coast and had been quite startled by its effects, especially in the blocking of the molar teeth and the improvement of the overbite.

The papers that evening had been very interesting, and he thought that a great deal more would be discovered about the Norwegian system when more people were using it.

Mr. L. Russell Marsh, after congratulating the authors on their excellent and instructive papers, said that none of them had stressed the fact that with the Norwegian apparatus there was a condition of continual and persistent growth and that that growth was made use of and was guided by the apparatus. In the cases of deep overbite, he thought there was not so much a depression of the incisor teeth, as suggested by Mershon, as a continual up-growth of the released posterior teeth, which came into line with the overgrown incisors.

He agreed with Mr. Endicott that the important function of the Norwegian apparatus was intermaxillary traction and that the subsidiary effects were often produced more rapidly by other appliances, but it was important to remember that traction should be undertaken at as early an age as possible and that in order to produce that subsidiary effects one should not delay the use of traction too long. The earlier traction was undertaken the better.

He had been guilty on occasion of doing one job by night and one by day, and he had been quite successful with that treatment. He had brought about the movement of the instanding molar with a spring on the daytime plate, and that was not interfered with by

the wearing of the night plate. Like Mr. Endicott, he had had a patient who wore the Norwegian plate night and day, and it had resulted in proceedings in Court, because the parents of the patient were separated, and the mother brought the child for treatment and was told that the child was to wear the plate at night only, but the child wore it by day also. The father was horrified and rushed the child off for a second opinion, and the mother got an injunction to prevent the extraction of the premolars by the dentist who gave the second opinion. The case had been very successful.

He had been very impressed by Mr. Grossmann's paper and would like to have seen a picture of a pathological specimen in which active force had been used, so that he could have seen the difference. He would like to ask Mr. Grossmann whether the favourable pathological results produced by the apparatus were due to (a) functional movement, (b) slow movement rather than rapid movement, or (c) intermittent movement or movement at night only. It was a question whether the same normal results would be produced by the use of a plate the whole time, provided one did not use too rapid movement, or whether the movement had to be intermittent, or whether a functional plate had to be used rather than one with springs.

The experiment on the baboon was most interesting, and he would like to ask Mr. Grossmann what was the age of the baboon and how that age compared with the age of a human being, as he thought that was rather important. Was it possible that any of the new bone on both sides of the condyle was due to normal growth in the case of a young baboon?

With regard to the last case shown by Mr. Grossmann, the boy of 14, was that a true Class III case or a symptomatic case?

Mr. C. L. Endicott said that the question of the depression of the incisors or the elongation of the posterior teeth was a very controversial one and he did not think that anyone had settled it definitely. He had felt, since he had become particularly interested in muscles, that, although one could facilitate the full vertical development in the premolar and molar area, one could not do anything to bring that development beyond what it would normally be, because of the equilibrium between the muscles. Ultimately both sets of muscles must be in a state of balance, and he doubted whether there was any possibility of elongating those muscles. Therefore he felt that there was a depression of the incisors, but Mr. Russell Marsh was quite right to question that point, because it was still a very controversial one.

Mr. W. Grossmann said that the changes shown in the slides in cases treated with the Norwegian plate had been explained to be due to intermittent force. If very weak springs were used for a short period, the same histological changes, the same tissue reactions and the same bone transformation should be obtained as were obtained with the Norwegian plate. The difficulty was to adjust the springs so as to produce such weak forces.

With regard to the age of the baboon, he was afraid that his knowledge of comparative anatomy at the present time was very poor. He could only say that the baboon was having a mixed dentition. Some comparison had been made with other baboons to exclude the bone changes on the temporo-mandibular joint. The baboons showed similar appearances, but it was quite obvious

that the baboon which underwent the treatment with the Norwegian plate showed far more excessive signs than the ones which had no such treatment.

The Class III case which he had shown was symptomatic. The patient was unable to bring his jaw further back, and it remained, in the maximum distal occlusion, slightly forward of the lower incisors. The patient had extractions during the treatment.

Mr. H. Chapman said he had not expected that so much interest would be shown in the Norwegian system as was evidenced by the large attendance at the meeting, and he thought the size of the gathering was the greatest compliment that could be paid to the authors.

It so happened that shortly after the 1914/18 war he had been in Paris and had seen appliances similar to the Andresen. All he could remember now was that he came away with very much the same impression as Mr. Endicott had at first. He regretted that he could not recollect what the plates were to do, and his impression had probably been quite wrong. The plates which he saw then seemed subsequently to have disappeared, but he thought that the present Norwegian plates were very similar to them. When he was in Brussels last October, Dr. de Coster had told him of a plate he made which had what might be called side bite guides without any front ones. He had not actually seen one of those plates, but he could quite believe that the side bite guides alone would be more effective in bringing the mandible forward than just an anterior bite. But undoubtedly the complete bite plate (he hoped that expression conveyed what he had in his mind) distributed the pressure over the entire lower jaw in such a way that it could do nothing but come forward, although the patient swallowed or sucked, and it seemed to him remarkable that the plate, working at night only, had the effect of bringing the mandible permanently forward. He was glad to hear from Mr. Grossmann that the histological effects which brought that about were probably in the joints. It seemed to him to emphasise the fact that the plate, as far as could be judged from what the authors of the papers had said that evening, was more useful for that purpose than for individual tooth movement. He was not at all convinced that individual tooth movement could be brought about permanently by the Norwegian appliance worn at night only. In that connection one had only to think of thumb-sucking. A child could suck its thumb for three or four years, but if the habit ceased entirely at the age of eight years the natural condition would almost certainly obtain by the time the child was nine years of age ; in fact, there would be a total relapse of the movement that had taken place. Therefore he was not convinced that the Norwegian system could overcome the difficulty, and he was glad that the authors had not claimed too much for the system ; they had said what it could do, and he was quite convinced that in a number of cases the effect was what they had stated it to be.

He remembered that a number of years ago he was told that teeth moved away from plates. That was partly true, but he imagined that the movement away from plates must be in a buccal or labial direction and it could not go on for ever ; otherwise people wearing partial dentures would be in a constant state of trouble. Therefore it was necessary to use a little discretion in the

application of the statement. The Norwegian plates were not only to move the teeth buccally but to move them medially and distally. Did that movement actually occur? The authors had not convinced him that it did. If the upper teeth were moved back, were they all moving back and where did they go to? If one moved the lower ones forward would not one move the cheek teeth further forward than the incisors, so that one upset the alignment? He felt that the authors had supported his view, because he gathered that in the treatment of the simplest cases, which the authors had emphasised, if the lower jaw was a perfect arch the upper teeth were arranged previously to the plate being put in, so that the occlusion was perfect. That was something that he could understand, and, if it was so, the backward-forward movement did not seem to him to be an important item.

He would like to express his personal thanks to the authors for the large amount of work which they had done on the subject dealt with in their papers.

Mr. C. L. Endicott said he thought all the authors had emphasised the point that where they only wanted to secure individual tooth movement they found that other means were more effective than the Norwegian appliance, but it would probably have been noticed that in one of the cases of which Mr. Grossmann had shown a slide the width of the arch in the upper jaw had changed very appreciably. He thought that was an interesting point. In certain cases, in which it was felt that the upper arch must be widened appreciably before a change was brought about in the arch relationship, he sometimes put in an upper expansion plate, which the patient wore at night only for a time, and then, after the desired result had been obtained, he often changed over to the Norwegian plate. The case which Mr. Grossmann had shown, however, demonstrated that that procedure was not always essential.

With regard to relapse, he had not yet had an opportunity of following up enough cases treated with the Norwegian appliance and comparing the relapses in those cases with the relapses that occurred when fixed appliances were used, but his impression so far was that relapse was less likely to occur when the Norwegian appliance was used. He could not state definitely that that was so, but, if it were so, he thought the reason for it might be that the Norwegian appliance depended so much on the muscles that it helped to establish a very greatly improved state of the muscles, which might not be achieved in the case of fixed appliance therapy. He thought that was why Rogers, who in his muscle exercises worked on the same basic principle, emphasised the value of muscle exercises in connection with so many of his cases.

With regard to the trimming of the plate so that movement took place medially and distally, that movement might take place, but he had never seen it. It always seemed to him that the trimming medially and distally performed a very valuable function. The plates did not begin to have any effect at all until they fitted very lightly in the mouth, and the trimming medially and distally interfered very greatly with the fit of the plate. He had never been able to measure the medial or distal movement, and he did not know whether it occurred or not.

Mr. W. Grossmann said he thought that individual tooth movement was best demonstrated in severe Class I, Division 2, cases.

Mr. W. Trevor Johnson said that he had done a little work with the Norwegian plates and his experience did not agree with many of the statements which the authors had made. He had had several quite successful cases in which there had been no filing at all ; in fact, the plate as he had made it had been no more than a splint which held the whole of the mandible forward by engaging the occlusal surfaces. He would not like to say, however, that his cases had been other than very favourable cases. He had not studied the subject carefully enough to add very much to what the authors had said.

Mr. H. T. McKeag said that he had been sufficiently long in practice to know fairly well what he could do with the sort of appliance to which he was accustomed and to know that there were certain things that he could either not do at all or only do with considerable difficulty or uncertainty, and the Norwegian appliance seemed to offer him a possibility of dealing with those cases which he regarded as being beyond his capacity to deal with by orthodox pressure methods. Those cases were, in general, where the lower arch was too small to fit the upper. Even when it was brought into relationship the lower anterior teeth were markedly sloped forward, so that if they were brought into normal antero-posterior relationship with the upper teeth, the incisors, there was a good deal of rearrangement. The cases that had been illustrated by the authors did not answer the question at all. He thought it would be generally agreed that they were cases which could be treated by other means. Therefore the question so far remained unanswered.

Another question was whether there was any definite advantage in the Norwegian system in making a reconstruction of the framework of the face by the use of muscle pressure in an intermittent fashion. He thought there might be something in that, judging from the pictures which Mr. Grossmann had shown him, which seemed to indicate a general state of activity rather than the concentrated localised activity that was seen in histological slides from Oppenheim's investigations and similar investigations on the use of springs. The general impression that he obtained was that the condition around the teeth in Mr. Grossmann's specimens was a generalised activity rather than a concentrated activity of osteoblasts and osteoclasts in particular localities. It seemed to be indicated that the effects of the muscle pressures might be more far-reaching and more widely distributed than the effects of spring and general elastic pressures.

One of the difficulties of the Norwegian method was that it did not provide for control ; if one was not working on individual teeth one could not have a slide of a tooth that had not been under pressure on the other side of the mouth.

He certainly did not regard the journey he had made in order to attend the meeting as wasted and he was very grateful to the authors for their papers.

Mr. C. F. Ballard said he agreed with Mr. Endicott that the Norwegian appliance did the same work as intermaxillary traction, but he had reverted to the fixed appliance to produce rapid individual tooth movement.

Reference had been made to the advancing of the mandible, and he thought that question ought to be considered more fully. First of all, Mr. Grossmann had spoken about functional stresses

producing bone changes. No one had yet demonstrated that it was possible to advance the mandible, and he thought that the changes which took place with the Norwegian appliance were changes in the alveolar bone and were exactly the same changes as were produced with intermaxillary traction. The idea that changes of muscle action on bone could produce a change in that bone, in its shape and in its internal and external form, was not regarded as sound by anatomists, and the experiments which had been done and the analysis of the results of treatment which Brodie published in 1941 bore out that opinion. Therefore he thought the changes were not ones which would advance the mandible but were changes within the alveolar structure.

With regard to intermaxillary traction producing the same result, he found that with the Norwegian appliance normal occlusion could be produced in about two years. With the use of intermaxillary traction at night only he could produce the same result, but he found that both results relapsed, and he thought the main use of the Norwegian appliance was to retain the result and to re-educate the musculature. Therefore he used the Norwegian appliance only as a muscle educator. It was an excellent appliance for producing normal lip action in a case which started as a Class II, Division 1 case, the so-called mouth breather. If such a case was treated with intermaxillary traction and then with the Norwegian appliance a remarkable change occurred in the facial musculature, and the same applied to the true mouth breathers. If one of the Norwegian appliances was fitted in their mouths, an amazing change in the musculature of the tongue, the soft palate and the lips occurred. He agreed that the child that sucked its thumb was delighted to have its thumb replaced by an appliance which at the same time re-educated abnormal muscle action.

Mr. Endicott had mentioned expansion in Class II, Division 1, cases. He himself never did expansion in those cases; he found that if he corrected the antero-posterior abnormality of the occlusion any expansion which was required adjusted itself; it occurred as the result of the change in the muscle action of the lips and the tongue.

Mr. H. G. Watkin said that he had been to Paris and seen the plates to which Mr. Chapman had referred, but he had not thought that he would be able to persuade his patients to wear them. He felt now that he would have to start again and pay more attention to the Norwegian system.

One useful result of Mr. Endicott's paper would be to make the members more conscious of the muscular action of the mouth. In most textbooks far too little stress was laid on the action of the muscles. It was known that the teeth arranged themselves in a position of equilibrium between the outward pressure of the tongue and the inward pressure of the lips, and in cases where the teeth were spaced it was no use trying to push them back into position, because the tongue would push them out again and relapse was bound to occur. Therefore the size of the tongue should be reduced, that being a very simple and successful operation. He would like Mr. Endicott to include in his paper a reference to the mouth screen, which was a loose piece of apparatus in the mouth, its chief function being to use the natural force of the muscles; it held the

cheek teeth away and allowed the tongue to act, and a very good expansion was obtained.

With regard to relapse, could Mr. Endicott say what happened to his cases five years later? It would be very interesting to know that. He thought there was less likely to be relapse with the Norwegian system of treatment than with ordinary intermaxillary traction. In Class II, Division 1, cases he used a mouth screen, which prevented the lower lip getting underneath and also prevented mouth breathing.

Mr. K. E. Pringle, referring to the space between the premolars in the working bite, said that Mr. Pedley had referred to it as 2—3 mm. and he would like to ask whether it would make any difference if the space was 4 mm. He had recently been widening it to rather more than 2—3 mm.

He would also like to ask Mr. Pedley at what angle he made his inclined planes so as to guide the teeth buccally.

Miss K. C. Smyth, after expressing her appreciation of the papers, said she thought that in every case shown on the screen the premolars had erupted. Mr. Russell Marsh had mentioned the desirability of using the Norwegian appliance early. She would like to know whether the technique was in any way different when the deciduous molars were present instead of the premolars and whether the technique of cutting away medially and distally was the same if the deciduous molars were present. Was the movement obtained in the same way at the earlier stage?

Mr. R. E. Rix said that he had used the Andresen appliance in the last six months and so far his results had not been very impressive, but that might be due to his ignorance of the technique.

He would like to ask whether the authors had found that the use of the Andresen plate corrected the abnormal habit of putting the tongue between the teeth during deglutition. He had used it to try to cure that habit, but so far he had not been successful, and he would like to know whether the authors had achieved anything in that direction.

With regard to Mr. Endicott's impression that relapses might be less frequent when the Andresen appliance was used, might not it be due to the fact that he carefully selected his cases? Mr. Endicott was dealing probably with arches that were well developed in the first place and not with small jaws; it was just a question of correcting the post-normality, and those cases were in fact satisfactorily and permanently cured with any sort of apparatus that exercised intermaxillary traction. He thought that the use of intermaxillary elastic was the surest way of effecting the rapid correction of post-normality.

Mr. H. Anderson thanked the authors for their excellent papers and said there was one question that he would like to ask Mr. Endicott. In the case of the early loss of the first mandibular molars and the consequent tilting of the second molars, by relieving the pressure from the molars would not one get increased tilting?

Mr. C. L. Endicott, in replying to the discussion, thanked Mr. McKeag for his very interesting remarks. He thought there was nothing very controversial in them.

Mr. Ballard rightly objected to the use of loose terms, such as "advancing the mandible". It was difficult, in presenting a subject

of the kind in question, to use terminology which would convey one's meaning to the people whom one was addressing. The "advancing of the mandible" was an expression that was very frequently used, certainly in relation to the profile. A big change took place, but whether it was a natural advance of the mandible or merely a change in the alveolar bone or a change in the angle and position of the condyle he did not know. He had not yet read anything which satisfied him completely on that point. The fact was that the occlusion did change; the postnormal relationship was corrected, and with that one often saw clinically a good deal of brightening up of the patient. Whether that was largely psychological or whether the relief of glossoptosis entered into it was a question to which a satisfactory answer had not yet been provided.

With regard to expansion in Class II, Division 1, cases, he liked to get a little expansion first, as it facilitated and speeded up the correction, but he quite appreciated Mr. Ballard's view that it was not always necessary to pay attention to that, because in the correction of the arch relationship and the muscles that change was brought about. That was most spectacular with the screens; when they were made up to rest heavily on the anterior teeth the amount of expansion that sometimes took place in the upper arch as a result was amazing.

With regard to Miss Smyth's question about younger cases, he had not had any experience of younger cases, but Mr. Pedley had. It seemed to him that the results had been more successful with older patients. In one case of Mr. Pedley's, the models of which were exhibited at the meeting, a really remarkable change had taken place.

With regard to Mr. Rix's question whether the Norwegian appliance would correct the habit of putting the tongue between the teeth during deglutition, that was a question which he had intended to ask Mr. Rix. Some very valuable work on swallowing and the effects of swallowing had been done by M. Rix, and he thought the Society could look forward to some very interesting information forthcoming ultimately as a result of Mr. Rix's experiments. It was certain that all the faulty muscle habits tended to become eliminated with the correction of the occlusion, the correction of the profile, and so on, by the Norwegian method.

As to the suggestion that he had selected Class II cases which would respond to treatment with any apparatus, he had with him some models of a very marked postnormal case in which a lower 6-year molar had to be lost and one on the opposite side was very doubtful indeed, and the uppers were not much better. He therefore had all four 6's taken out. When one wanted to use a fixed appliance and all the anchor teeth were lost, one was in a difficulty, but the Norwegian appliance was very useful indeed in such cases. A very good result had been achieved by its use in the case to which he had just referred, whereas there would probably have been some difficulty in treating it with any other appliance.

Mr. W. Grossmann, referring to Mr. Ballard's suggestion that no direct relationship between bone structure and mechanical stresses employed on the bone had been proved, said that question had not been examined for the first time in the case of the jaw. It had been examined very extensively in the development of the femoral head in children, where it had been shown that when

certain muscles had been paralysed the bone structure changed considerably, the direction of the bone of the femoral head being entirely dependent on the muscle action and mechanical forces bringing pressure on to it. He thought that those examinations had proved that there was a direct relationship between stresses and bone formation.

Mr. V. Pedley, replying to the two questions asked by Mr. Pringle, said he did not think that any measurement could be fixed for the space between the premolars in the working bite. He thought that it varied between 2 mm. and 5 mm. according to the individual case. He had tried opening the bite very much more as an experiment, and it had resulted in the patient suffering fatigue and discomfort.

The inclined plane was made at an angle of about 45 deg. When the Coffin spring was introduced the plate was divided in half, which was not a very good thing to do, because the Norwegian plate acted as an internal oral screen and when it was cut in half air got through. He thought that the Coffin spring increased the angle of the plane by bringing the teeth into contact sooner with the plate and so steepening it, but the average angle was about 45 deg.

On the motion of **The President**, a vote of thanks was accorded to the authors of the papers, and the meeting then terminated.



DIAGNOSIS OF A CASE OF MARKED ASYMMETRY

By

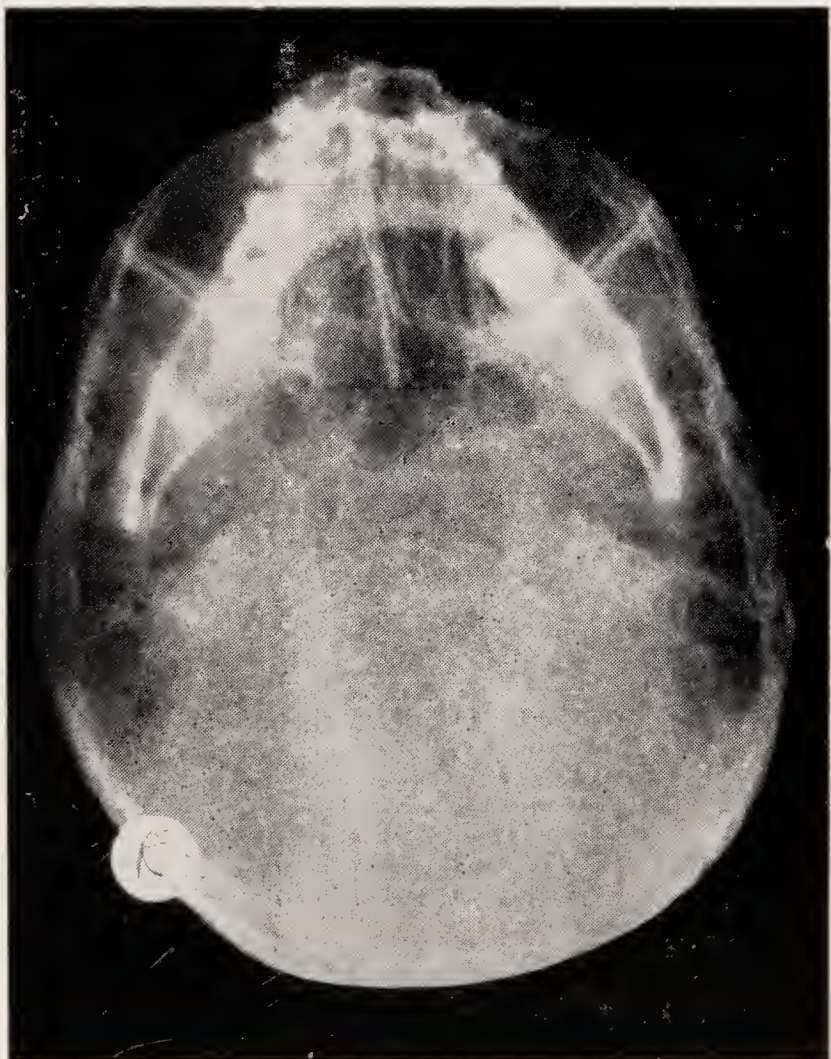
W. TREVOR JOHNSON, L.D.S. (Eng.),

When I offered this communication, I believed the case to be one of asymmetry due to difficult labour although the history confirms difficult labour and some facial injury, I am now in doubt.

The first slide is of a frontal and dorsal view of the models at 12.9 which were to be oriented to the Frankfort plane but contact with the patient was lost after the second visit, and so this has not been done. It will be seen that the centre of the maxillary incisors has drifted to the left, and that the left canine is high up labially and shut out of the arch. The maxillary first permanent molars and first premolars are all rotated, but this rotation is more marked on the left than the right. On the left side there appears to be a deficiency in lateral, vertical and, probably, forward growth, and from a frontal view the line of the maxillary teeth runs upwards as far back as the second premolar, and the deficiency in vertical growth is compensated by an increased vertical growth in the mandible. The curve of Spey is reversed. The dental papilla and frænum have moved to the left with the teeth, but it will be seen in the next slide which is a vertical submental view of the skull, that the median suture has not moved to the left with the teeth and that, in relation to this suture, the affected side has contributed more to palatal width than the unaffected side. The distance from the head of the condyle to the anterior end of median suture is nearly the same on the two sides which suggests that the basal bones of the skull in this area and the mandible are more symmetrical. The next slide is an antero-posterior view of the skull and the drift of the maxillary teeth to the left is more distinctly shown. The nasal passage is better developed on the left side, which is the affected side, than the right side, and they, too, are asymmetrical.

Since this paper was delivered, Professor H. J. Drew-Smythe has written me and says he agrees with Hudson in his discussion on Sir Frank Colyer's paper, and adds:—"In the moulding of the head at birth, only the vertex of the skull is affected; the base is unaffected. In a vertex presentation, and this includes a brow presentation, there may be some distortion of the malar bones but definitely not of the maxilla or mandible. Neither could forceps delivery affect these bones, even in inexperienced hands. In the case of breech delivery, in inexperienced hands injury to the mandible may occur, but this is more likely to affect the incisors only. In my opinion, asymmetry of the face is a congenital deformity due to irregular development of the two sides of the body. Conditions in utero may affect this development, namely, the pressure





of some tumour, i.e. fibroid or ovarian cyst. I have seen one case in which this was particularly marked and remained so throughout life."

Professor J. M. Yoffey gives us an anatomist's view and says he has never seen, and would not expect, any marked degree of asymmetry from birth injury.

The more than usual inclination of the maxillary incisors to the left, the deficiency in vertical growth, and the greater contribution of the side with the smaller nasal capsule to palate width, do suggest some major congenital influence, but drifting of teeth following premature loss of deciduous molars have no doubt played a part.

I should like to record my thanks to Dr. G. B. Bush for the X-rays and to Professors Drew-Smythe and Yoffey, of the University of Bristol, for their kind help in discussion.

DISCUSSION.

Miss L. Clinch asked whether any more details could be given by Mr. Johnson about the labour itself.

Mr. Harold Chapman said that he remembered, when this subject came forward previously, that good authority was cited for thinking that labour did not as a rule cause any definite troubles. If there were any troubles arising from that cause it seemed to him that they must be more severe than appeared in Mr. Johnson's case. It was remarkable how the incisors had drifted over to the left side, and yet the sutures remained the same; nevertheless he felt that this was a purely dental condition rather than a more general one affecting the whole organism. He thought there must be some local cause at work rather than a general one. There seemed to be a localised defect of growth on one side, although this did not seem to be very definite, because the length on the two sides was similar. Some local effect such as the result of a habit might be the aetiological factor in this case.

Mr. J. H. Hovell asked whether there was any associated Bell's palsy or any upset of muscles on the affected side. Much more injury was produced by mal-function of the muscles than was frequently supposed.

Mr. Maxwell Stephens said that there might be more than one factor concerned in causation. He would recommend those who had not yet come across it to study Sir Frank Colyer's article in a copy of the **Proceedings** some three or four years' ago on association of these conditions with difficulties in labour.

Mr. Trevor Johnson, in reply, said with regard to Miss Clinch's question, he had enquired on that subject, but the patient was under a general practitioner and he had had no details.

He thought that the point made by Mr. Chapman needed very careful study. In his view the asymmetry was probably partially due to local disturbances, particularly to the loss of the deciduous molars, but there was also deficiency in the vertical growth and this was rather against the usual finding in these local cases. There was no history of muscular trouble and the face was quite normal.

THE 'IMMEDIATE' CONSTRUCTION OF A THUMB GUARD

By

W. Trevor Johnson, L.D.S. (Eng.)

An immediate thumb guard constructed of stainless steel tape, 2.00 mm. by 0.50 mm. is illustrated. The joints are welded and a loop is provided for tying the appliance to the wrist. It can be constructed in five minutes.



THE PHILOSOPHY OF ORTHODONTICS

By

B. R. TOWNEND, L.D.S. (L'pool.)

The word philosophy has been frequently used of late, particularly by our American cousins, in a somewhat loose and meaningless way. We have all seen articles entitled "The Philosophy of the So-and-So Arch" or "The Philosophy of the Such-and-Such Appliance," when technique might have been a more satisfactory word. I realize that my title may have prejudiced some of you against my paper unheard, but in spite of this grave danger I have stubbornly stuck to my first choice because it represents I think the essence of what I have to say. My dictionary tells me that in the original and widest sense, philosophy means "the love, study or pursuit of wisdom, or of knowledge of things and their causes whether theoretical or practical." Under that definition I think we can all regard ourselves as philosophers. But there is a more particular and now more usual interpretation of the word which better expresses what has prompted this paper. It is that "philosophy is that department of knowledge or study which deals with ultimate reality, or with the more general causes and principle of things." That definition is my *apologia* for my title.

There are, it seems to me, two avenues of approach in any science: the scientific, that is the approach of the discoverer; and the philosophic, that is, the approach of the man who endeavours to comprehend and interpret the true meaning of things and to dig down to their ultimate reality. Thousands of people knew what milkmaids said about small-box, but it took a Jenner to appreciate its true meaning, and so he became one of the landmarks in the art of healing. The Jenners of science are rare birds for the simple reason that the philosophic approach is rarer than the scientific.

Claudius Galen said: "Diagnosis is the awareness of all things present." If I might presume to add one word and alter Galen's dictum to "Diagnosis is the awareness and comprehension of all things present," we then have the ideal and ultimate combination of the scientific and philosophic approaches, and if we can satisfy these two conditions at all fully, the world is at our feet.

My endeavour this evening is to suggest to you very crudely, very tentatively and haltingly, some of the background of orthodontic defects of which we should be aware, and which we should endeavour to comprehend. When you have heard my paper you may accuse me of trying to teach my grandmother to suck eggs, but I will risk that accusation.

Just a word as to the generation and birth of my essay. I, as a public dental officer, have long realised that the orthodontic teaching we receive in our schools is quite inadequate for the purposes of those of us who take up children's dentistry as our

life work. This is neither the time or place to discuss how this gap may be best filled, but it has long been a dream of mine to do something to fill it. This dream has recently become a reality and I have been giving a series of orthodontic courses to members of my staff, not with the idea of presenting any practical knowledge or training, but rather to suggest something of the orthodontic implications inherent in their day to day work or in other words, to give them orthodontic insight. In giving these courses I have been very much in the position of the Clerk in Chaucer's Prologue, "Gladly wold he lerne and gladly teche." In addition to this, I am slowly trying to develop a diagnostic chart with the idea of covering some of the information which I consider is necessary in assessing an orthodontic defect of any complication, and it is the combination of the thoughts which have arisen in my mind while carrying out these two tasks which forms the skeleton or background of this paper.

I suppose we should not be very far from the truth if we said that every orthodontic defect was produced by genetic and/or environmental influences, using the two adjectives in their widest sense. Life from conception to the moment of death consists of a constant battle between these two factors, and I think it is very essential that the orthodontist should have as full an awareness and comprehension of what is involved in these matters, their correlation with each other, the gross or subtle interplay between them, and the likely results arising from the swaying fortunes of this biologic battlefield.

It is obvious that if we had complete awareness and comprehension of all these factors, our task would be an easy one, but as we all know, the matters involved range over the widest fields of human thought and endeavour, and there are vast and terrifying chasms in our knowledge, but we must not let that deter us in our search for truth.

Within the term genetics we must include wide vistas of human evolution in which have been produced the face, jaws and teeth of *homo sapiens*. The uprighting of the body instituted by our tree-living ancestors has brought about a downward bending of the craniofacial axis with a shortening of the dental arches and consequent increasing difficulty in providing room for the backward growth to accommodate the teeth in the maxilla and mandible. It has been suggested that the human face is in a difficult and terminal state of transition or even retrogression which gives us an evolutionary predisposition to malocclusion. The fact that man is, I think, the only animal with no spaces between his teeth rather supports this idea. If this is true, it has some practical bearing upon our work in that it supports the biologic wisdom of the practice of reducing tooth substance in that by so doing we are carrying out in a moment what nature may take thousands of years to perform. So much then for the long and wide view of genetics.

When we come to consider genetics in the more particular sense as it applies to individuals, we are immediately confronted with an extremely complex problem. As you know, the fertilized human ovum contains 48 chromosomes, each containing thousands of genes, so that heredity may express itself in countless combinations. The genes are the character conveyors of the body, and the characters they convey may be physical, physiological, metabolic,

neurotic or psychic. Broadly, we may say that a child may inherit tissues that are susceptible to the evolvement of malocclusion or that it may inherit structural conditions which may be physiological, metabolic, glandular or nervous that lead to a stimulation or depression of growth forces or to an unbalancing of environmental tissues which render malocclusion most probable.

We deduce from this that genetic factors may be, and often are, the ultimate causes for which we have to look. For instance, at first thought we might consider that a malocclusion produced by thumb sucking was purely environmental in origin, but it may well be that the habit arose from some psychic factor which the child inherited from its ancestors.

It is, of course, a fact that all individuals do not and cannot respond similarly to exactly the same experience, and this fact demands analysis and explanation.

Stockard, in his book *The Genetic and Endocrine Basis for differences in Form and Behaviour*, suggests that some explanation of this fact may be found in certain modifications of the endocrines which are clearly hereditary and are co-related with structural and functional peculiarities of the human body.

Stockard found, in his work which was done on dogs, that in the highly modified skulls which resulted from the crossing of extremely dissimilar breeds, the size of the teeth was quite independent of the size of the jaws; that the lengths of upper and lower jaws were inherited independently; long jaws bred with short jaws exhibited various disharmonies, such as a long upper with a short lower, or *vice versa*.

Modifications of the mandible in hybrid dogs were not so pronounced as those of the maxilla, suggesting that mandibular deformity in malocclusion is largely secondary. Stockard found that superior and inferior protrusion in hybrid dogs was similar to that in humans, raising the implication that theories which consider that these conditions arise in children owing to purely environmental causes such as mouth breathing or thumb sucking may need some revision.

Stockard believed, as I have stated, that differences in an individual's response to similar experiences and stimuli could be laid down to a great extent to modifications of the secretions of the endocrine glands which in their turn were inherited characteristics. There is, I think, overwhelming evidence to support this belief, and from this premise we are led into a wide field of speculation as to whether many of the basic causes of malocclusion such as defective and arrested growth which we attribute to improper diets, pathologic conditions in the nose and throat, or generally poor health, may not in many cases be ultimately referable to endocrine disturbances and imbalances which may be genetic in origin. In other words, to repeat the point I made earlier, the trouble may lie in the inherited structural conditions which are susceptible to the various disturbances which in their turn aggravate an already existing evolutionary trend.

These factors of depression or feebleness of growth which are responsible for so many of our problems whether due to hereditary or environmental causes, probably affect the different parts of an organ in the order of their comparative plasticity. In the masticatory apparatus the muscles are first decreased, then the bone

and finally the teeth. This is probably the reason why feebleness of growth with concomitant insufficiency of bony tissue to support the full dentition is one of the most fruitful causes of malocclusion and anyone who expects to be able to move and retain teeth in normal occlusion in a person whose whole physiology and morphology is subnormal or disturbed is doomed to frustration and disappointment.

There is another matter in the etiology of malocclusion which is intermixed with the genetic background of the individual and consequently with his endocrine modifications. I refer to the easily observed fact that there are certain broad types of physical development and general appearance having characteristic and quite different responses to biologic stimuli and experiences. For a detailed analysis of these types, I would refer you to Kretschmer's fascinating work, *Physique and Character*. Kretschmer describes three types, the Leptosomic, the Pyknic and the Athletic. The Leptosomic is the long and slender type with narrow shoulders, prominent scapulæ and a long, narrow, flat chest. He has a thin stomach and legs, slim arms and hands, and his face is high and narrow with a tendency to under-development of the mandible. Leptosomic children are often weakly, they have a tendency to shoot up at puberty, they eat a lot but remain thin. The Pyknic type contrasts with the Leptosomic in that he is of the short squat variety, with a short neck sitting well between the shoulders, which are rounded, rather high, and pushed forward on a barrel-shaped chest. The trunk is compact and the face broad and less high than in the Leptosomic ; there is a tendency to excessive deposition of fat. The Athletic or Muscular type has strongly developed muscles with broad shoulders, a superb chest and skeleton with a tapering trunk from above downwards. A solid, long head, with a well-marked trapezius supporting it. The mandible is square with a tendency to prognathism. There is a tendency to corpulence in later life. Not only do we find these marked differences in physical appearance, but also the different types appear to have psychosomatic differences as well. Gastric and duodenal ulcer appears to be the characteristic disease of the Leptosomic and gall-bladder disturbances more common in the Pyknic type. In the obscure province of the soul, the Leptosomic appears to have a bias towards schizophrenia which may account for the fact that many poets and artists fall within this category. One thinks offhand of Shakespeare, Dante and Voltaire. The Pyknic tendency seems to be towards manic depression. The Pyknics are the "doers" of the world—Winston Churchill, Napoleon, Stalin, and a host of others. The Athletic type is perhaps characterised by more brawn than brain, so that his psychology is relatively simple and primitive. He is concerned with punches rather than with poems or polemics. The shape and architecture of the dental arches in the three types vary considerably. Speaking broadly, the Leptosomic pattern is the long, narrow jaw, giving rise to malocclusions involving insufficient width of the palate and mandible with defective or arrested mandibular development in contrast to the Pyknic type with a tendency towards deficient antero posterior growth of the jaws with consequent danger of generalized crowding, and various impactions. The Athletic type, as we have stated, tends towards prognathism of the mandible.

Kretschmer's work is a very valuable jumping-off place in our study of constitutional types which has undoubtedly a profound bearing on our subject, but it is scarcely refined enough since it deals with extreme types and regards the individual as all of one piece. A considerable degree of refinement has been provided by the work of Sheldon and his co-workers who have considered that individuals differ according to the dominance of endo-, meso- or ectodermic tissues in their constitutional make-up. Thus the endomorphic component dominates in Kretschmer's Pyknic type, giving a predominance of soft roundness with massive digestive viscera which are, of course, endodermic in origin. In the Athletic type the mesomorphic component is dominant with a corresponding dominance of muscle, bone and connective tissue. In the Leptosomic type the ectomorphic component holds sway with a relative predominance of linearity. The leptosome or ectomorph has the greatest surface area, and hence relatively the greatest sensory exposure to the outside world. Relative to his mass, his brain and central nervous system is greater than that of his fellows.

Sheldon has shown that these three morphologic components existing as they do to some degree in every individual, dominate in a sliding scale which he expresses as a figure ranging from 1 to 7. Sheldon also divides the body into five regions, i.e. (1) head and neck ; (2) thorax ; (3) arms, hands and shoulders ; (4) abdomen ; (5) legs and feet. The three components are determined by inspection and expressed on the scale from 1 to 7. Thus the head and neck may be expressed as 523, that is, it is 5/7 endomorphic, 2/7 mesomorphic and 3/7 ectomorphic. Variations may, of course, occur in other regions.

This study is so recent that as yet little use has been made of it, but it appears to me to have great possibilities and awareness of it should do something to broaden our outlook of the many implications lying behind our specific problems of malocclusion. I would remind you in this connection that in that valuable contribution to our knowledge of post-normal occlusion which was carried out some years ago under the auspices of the Medical Research Council, some surprise and bewilderment was expressed concerning the fact that the children suffering from distocclusion were on the average considerably taller than normal. I would suggest that Kretschmer's and Sheldon's work offers an explanation of this observation. The post-normal child tends to be of the Leptosomic or ectomorphic type, which has as we have seen a tendency towards greater relative predominance of linearity and consequently tends to be taller than his endomorphic or mesomorphic brothers and sisters.

I would stress that the general laws of inheritance will condition the development of the characteristics of the different types in different individuals, and they do not and cannot always occur in a pure state. I am inclined to think that it is in these "alloy" types with a mixture of features where facial disharmony and malocclusions are more likely to occur. A number of cases come to my mind exhibiting bimaxillary protrusion which appears to be the result of a Leptosomic arrangement of the teeth superimposed on a Pyknic variety of skeletal base.

We have now to consider what is the influence of these factors we have discussed on the growth and development of the human face and masticatory apparatus, but we must first be aware of and

comprehend exactly what we mean when we use the words growth and development. Growth has been described by Huxley as the self-multiplication of living substance but development is something quite different. Development or maturation, which may be either physical or psychological, implies an increase in complexity, as, for example, the formation of the four-chambered heart of the infant from the relatively simple pulsating tube of the embryo. As growth and development are intimately associated with the young animal they are usually both taking place at the same time, but one can have spectacular development taking place with very little growth, as in the first days following the fertilization of the ovum or where the growth of a child is checked by a disease such as rickets.

It would seem that in the life history of the normal individual, growth and maturation progress, as it were, hand in hand, and malrelations between those two forces outside their usual associations are probably responsible for many orthodontic defects.

We are now, perhaps, in a position to endeavour to comprehend what we mean by normality. We have seen that what is normal for one individual may not be normal for the next, and this concept involves criticism of endeavours which have been made by many workers to plot ideal or normal curves for the human dental arches. Such techniques seem to assume the existence of but one so-called "normal" form of arch, whatever the shape of face and head.

Normal does not mean simply usual, average or the best, but it usually carries a connotation of all these ideas. I would suggest that a good, working definition of normal might be, "absence of ill-health and incapacity with a correct morphology and functional performance." This definition covers the whole of the bodily functions but it can be particularly applied to the dentition. So long as a variation does not interfere to a marked degree with any of these conditions, I would regard a case as normal. In short, we may say that every individual is endowed by his heredity with certain possibilities of growth and development which may be a little more or a little less than the average. Our problem is not so much to determine whether a child conforms to a standard representing the average of his group, but whether or not he realizes to the fullest possible extent his own inborn potentialities. Put in another way we tend to inherit tendencies towards disharmonies and disturbances in growth and development which in turn produce abnormalities, rather than inherit the abnormalities themselves.

You may argue that this is a purely academic distinction but a little thought will suggest that it has some practical bearing on the problems which face us because such a concept helps us to be aware of and to analyse and comprehend the differences between what one might call basic and secondary causes. I have been criticized in the past and expect I shall continue to be criticized for my ideas on the part played by the premature loss of deciduous teeth in the production of malocclusion. I have never said as has been suggested that this mutilation is not a factor in certain types of malocclusion. That must be obvious to anyone who has seen a half-dozen cases of orthodontic defect. All I think—and I go no further than to say I think—is, that premature loss of deciduous teeth is a secondary factor which may aggravate or alter an underlying and basic cause of malocclusion, but if that basic and

underlying cause is not present malocclusion may not, and often does not, develop in such cases.

We must now consider some of the environmental conditions which are factors in the causation of malocclusion. In its widest sense, we must include within the term environmental such things as nutrition and disease as well as the more local conditions which may be present within the oral cavity. Nutrition and disease probably enter into the picture as a result of their influences upon muscular function and depression of growth, whereas the more local environmental conditions manifest themselves in muscular imbalances or perversions, excepting, of course, that rather large group of malocclusions which arise from such things as supernumerary teeth, cleft palate and hare lip, prolonged retention of deciduous teeth, etc., which do not enter within the ambit of this paper.

I have referred to the constant battle which is taking place between our heredity and our environment. The whole concept of this struggle has been expressed very succinctly by Ashley Montague in his *An Introduction to Physical anthropology* to the effect that although you cannot make a silk purse out of a sow's ear, you can by sufficiently lowering the quality of the environmental factors make a sow's ear out of materials that might under the influence of better conditions have been woven into a silk purse.

I would submit to you the thought that our success or otherwise in diagnosing and treating a case of malocclusion is entirely dependent upon our knowledge and understanding in recognising and weighing up the respective interactions of these two factors—in other words, our awareness and comprehension of all things present. It is a far from easy task, and our knowledge of many of the matters concerned is very limited. The picture is further blurred by the fact that similar end results can be derived from either heredity or environment. What heredity can do environment can do also. It is easy under such conditions to counsel despair but such is the nature of man, and your real orthodontist is a man if ever there was one—he has to be—we struggle on.

I should like to consider with you this evening more specifically those muscular imbalances and perversions which we classify as habits. Many of the more common and obvious ones such as mouth breathing, thumb sucking and the like need not concern us to any great extent but there are many occult and obscure habits which play an important part in malocclusion, and the importance of their role is comparatively unexplored territory. Here, I should like to pay a tribute to the pioneering work of Ernest Rix contained in his recent paper, "Deglutition and the Teeth." This paper has opened wide to me many doors of speculation which were hitherto closed and it is a privilege to be able to thank him for it.

The ability to form habits seems to be one of the characteristics of the human race and the very qualities which raise mankind from the rest of the animal world make him, to some extent at least, independent of the laws of nature which apply more consistently to the beasts. It was lack of appreciation of this independence that caused Descartes to formulate his system of philosophy, which by accepting the immutability of nature's laws applied to beast and man alike, laid down the principle that the aim of science was

to discover these laws and interpret all knowledge in conformity with them. Newton's conflicting theory that scientific inquiry must "set out from the observation of the actual facts of the objective world," provides a far more fruitful line of thought when studying the habits of man than what Lord Morley described as "Cartesian Scholasticism." It will be observed that Newton implies in his philosophy our original premise of awareness and comprehension of all things present.

It is interesting to speculate upon the fact that habits seem to develop more commonly in the functions and faculties which are peculiar to man. For example, in speech, from simple and often quite engaging mannerisms to gross defects such as lisping and stammering. One cannot conceive of a lisping or stammering hyena ! Our artificial ways of feeding and living have some relation to atypical swallowing habits and mouth breathing. Lastly, man's intelligence and imagination which gives him the power to range over wide fields of knowledge and learning, by a strange irony of life, renders him at the same time a ready prey to inhibitions, complexes, and other psychological menaces which often bring in their train a whole host of compensatory mechanisms, many of them nervous habits, which are unthinkable in the lower ranges of animal life.

It is not my concern this evening to consider in any detail the clinical effects of habits but I should like to draw your attention to the fact that by taking an all-embracing view of the child in terms of his genetic background and environmental surroundings we can expect to gain some guidance in our attempts at diagnosis. If we see evidences in the parents of nervous symptoms, if they seem highly strung or if they have habit spasms or the like, it is more than likely that they will have passed on these tendencies to their offspring.

There is another angle of speculation in connection with habits which I should like to bring to your notice. As I have suggested, many habits such as mouth breathing and thumb sucking are easy to recognise. We are readily aware of them and the comprehension of the effects they produce is more or less self evident. In the case of atypical swallowing habits, awareness and comprehension is not so easy. This suggests that there may be many habits which cause imbalances of the action of the facial and masticatory muscles and consequent malocclusions which may be even more occult and yet responsible for malocclusions. All of us have probably noticed in our own bodies certain tricks of muscular action which are carried out quite unconsciously and for no purpose. I well remember a few years ago getting perilously near to that strange clinical complex commonly known as a nervous breakdown. Difficulty in getting to sleep was one of the symptoms from which I suffered and after counting innumerable sheep I discovered one night, quite accidentally, that I was clenching my jaws together. I relaxed my jaws and promptly fell asleep and found on subsequent nights that I could repeat the process. I make no attempt to explain the psycho-somatic factors which must have been present, but my experience does lead one to consider the possibility of a much wider field in such matters than we have hitherto explored. The hyper or hypo tonicity of certain muscles of the jaws and face

may well arise from habit which if persisted in may cause malocclusion. Schwarz has referred to the possible influence of dorsiflexion and ventriflexion of the head during sleep on insufficient and excessive mandibular development respectively and one can think of a hundred and one other possibilities of muscular imbalance which if acting on an innate or acquired feebleness of growth may well be responsible for, or at least factors in, the development of malocclusion. I do most sincerely feel that there is a vast scope for investigation in these matters and would earnestly draw your attention to them. I have attempted to do no more than open a few doors of interest to you this evening.

It is now my pleasure to bring to your notice another aspect of orthodontic science which has, I think, been somewhat neglected in the past and might well repay a more intense and close study. Lord Kelvin once said, "If you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre, unsatisfactory kind." I think there is no question that most of us have in the past been inclined to carry out our orthodontic work by what has been described as the "By guess and by God" method and our status as a scientific body has suffered accordingly. We have been content with general impressions rather than with scientifically observed, measured and noted facts. May I disarm comment by observing that this criticism does not apply to all. One can think of many painstaking and meticulous investigations in the realm of orthodontics that fulfil the highest scientific standards, but, as a generalization, I think you will agree with my postulate. General impressions are very valuable triggers to start a train of thought or create an attitude of mind from which value may be gained, but once the path of investigation is under our feet we must be in a position to substantiate our impressions with solid facts.

An attempt was made in this direction some years ago by Simon of Berlin, and although his gnathostatic technique has been somewhat discredited of late, it did a considerable amount of good by making us aware of the need for relating the denture to the cranial anatomy. More recent work by Broadbent and Margolis using a roentgenographic technique has carried this concept and our awareness of it further steps forward and has also thrown light on many dark places in that complex of events which we call growth and development. I have been most impressed by the work of Brodie in which he has demonstrated in measurable terms the early establishment of growth pattern in the individual and the angular constancy throughout life of certain planes in cranial and facial anatomy. I must interpolate here in defence of British orthodontics that workers in this country, notably Chapman in 1934, hinted at these basic truths, but we must confess I think that our American cousins have placed them on a more scientific footing with regrettably few references to the basic work of some of our own pioneers. The interesting result to me of all this is that the Americans are coming round to our way of thinking with reference to the use of extraction of teeth as a therapeutic measure in orthodontics. I need not enlarge upon this to such an audience but to one who must begin to consider himself an old or at least an oldish man it is very entertaining.

I think Tweed's recent study of the constancy of the angle which the lower border of the mandible makes with the Frankfurt plane and its relation to malocclusion, has great possibilities as an aid in diagnosis and treatment. It is easily applied and I have been using it for some time now with a feeling that it has definitely increased my two postulates of awareness and comprehension.

One looks forward to the time when we can hope for a more accurate and scientific basis along these and similar lines on which we can build our work.

A final word. My professional life has led me along the paths of Public Dental Service, more particularly School Dentistry. During a quarter of a century I have seen many thousands of children and the feeling has gradually dawned upon me that in this service we have the opportunity if we will only take it of solving many problems and lighting up many dark places. You who are in private practice, or specialist practice, rarely see the normal, and inevitably your outlook tends to become warped in the direction of the pathological. I would suggest that we have not exploited sufficiently the angle of approach which says—why is this child normal? Our attitude has rather been—why is this child abnormal? I am inclined to think the former approach might yield rich dividends.

I have perhaps been guilty in this essay of that literary crime which Disraeli described as explaining the evident, illustrating the obvious and expatiating on the commonplace, but I have found support in my endeavours from the words of that great anatomist and anthropologist the late Grafton Elliot Smith who said, "we should not be deterred from saying the obvious when it is precisely the obvious that needs saying," and I would close with that prayer of one of the American admirals during the war which has a general connotation but which might also be well applied in a more particularized sense to our orthodontic problems.

"Give us the courage to accept with equanimity the things in life (or in the mouth) which cannot be altered. Give us the strength to alter those things which can and should be altered, and give us the wisdom to distinguish between the two."

DISCUSSION

The President said that they would desire to thank Mr. Townend for his paper. The paper had a very intriguing title. His Greek was inadequate, but he knew that *philos* meant a lover or a seeker after, and *sophos* meant the essence of truth. Thus they had a seeking after truth in orthodontics and that was a habit every orthodontist should acquire. Mr. George Northcroft, Mr. Harold Chapman, and others, had always stressed that need for seeking after truth. In their early days many of them were immensely interested in the increasing mastery of technique and the results achieved, but as time passed on and they found that failure went hand in hand with success—failure, indeed, often taking the van—the good orthodontist started to go back to his facts, to what was known beyond reasonable doubt, and, if he had the courage, to modify his views and methods in the light of it—the more credit to him.

But there was also a more general and looser application. They commonly talked of the philosophy of life, meaning their own approach to life, and the philosophy of orthodontics as their particular approach to orthodontic practice. They could think of the man who considered that all cases could be treated by extraction, the man who thought that all cases would come right of their own if left long enough untouched, and the man who was so afraid of any case at all that he sent it to the specialist.

The approach of the dentist to orthodontics should be to visualise himself as a gardener, as a tender of living things, getting help when needed, and seeking to know nature rather than arbitrarily to control her. As regards orthodontics itself, he definitely regarded it as of the female sex, at times capable of giving intense pleasure and a sense of creative fulfilment; at other times—occasionally at almost the same time—annoying, distracting, frustrating, almost beyond their male capacities to bear.

Mr. Harold Chapman said that he was glad that Mr. Townend had given them a definition of philosophy to begin with. As he had said they met it constantly in American literature, but never quite knew how to interpret it, though the word he had suggested, namely, “ technique ” probably solved the problem. Mr. Townend that evening had told them a lot about philosophy and nothing about technique, and, of course, that was the right thing to have done in accordance with the title of his paper. His classification of cases into genetic and environmental seemed to him correct, though in his own division he would use the more simple terms “ general ” and “ local ”, but they were really one and the same. It seemed an ingenious argument to suggest that thumb-sucking might be of genetic origin. Whilst the habit itself might be of genetic origin, change of position of the teeth must be, he thought, a local affair, and whether it should be carried quite so far as to invoke genetic origin he was not sure.

Mr. Townend had told them that in humans there were no spaces between the teeth. He was not quite sure that was true, though in the majority of cases, of course, it was so, but, as Prof. Friel pointed out to him, it was not at all uncommon to find a space between the first premolar and the canines in the upper, and recently he saw models of a similar condition in the lower, where the spaces were greater than in the upper. He found them also in cases of post-normal occlusion where the apical base was of normal size.

He rather gathered that Mr. Townend gave the impression that leptoprosopes were liable to have small jaws; he would not have thought that, but would have imagined that the leptoprosopes and the pyknics could have good-sized jaws and good occlusion in both instances, but, of course, the shape would be different. The shape of the jaws and the arches would conform to the general tendency, one being long and narrow and the other shorter and broader. This was brought out in two papers by Prof. Hoffman in the *American Journal of Odontology* and in the same periodical there was an interesting paper by Dr. Seezure on Mandibular development.

He quite agreed that the normal was very variable, and that kind of variation was again brought out in these two distinct types, leptoprosopes and pyknics, and there were individuals between these who shaded off from one to the other. Thus it was a very

variable condition and one about which they wanted to know more. The definition which he gave of normal was extremely good and one which he would like to memorise. He was not quite so clear about the struggle between heredity and environment. He could not quite follow the thesis that these two things should necessarily be at variance. Why should heredity and environmental factors be fighting one another all the time? But perhaps he had got a wrong impression from the paper.

The ending to the paper was excellent, but he would have liked the author to have made one addition, namely, the things which could be altered permanently. They could alter these arches and teeth and so on quite easily, but that was not the point. They had to alter them permanently and it was this which should be stressed. He found it very difficult to convince their younger colleagues that whilst they could alter so many things there were a lot of things which could not be altered permanently, and it required an experience of failures really to convince them.

They were very much indebted to Mr. Townend for the thoughts he had placed before them.

Mr. J. Aitchison testified to his extreme pleasure in listening to this paper. Very many points of practical orthodontic importance had been brought into it, and he desired briefly to touch on one or two. The Author had mentioned the fact of muscular relaxation in nervous breakdown. In certain systems of treatment of nervous breakdown muscular relaxation was regularly employed. The last muscles to cease to function were the muscles of mastication and expression. He had sometimes wondered what harm he might possibly be doing in carrying out certain orthodontic treatment in a highly nervous child. He thought that problem might show itself more forcibly in the future when they had established a system of dealing with certain children who had tense jaws.

The Author had mentioned that man was not liable to be as affected by environment as the animals. Recently he had the pleasure of attending Julian Huxley's lecture on the second biological evolution, in which he said that the animals had ceased their process of evolution entirely—that is to say, evolution under what he had termed the old scheme. Julian Huxley declared that man, and man alone, was still evolving according to the older method, but that in the lower animals natural selection had given place to human selection, and that the only animals not undergoing a process of degeneration, now that man had asserted his ascendancy, were those which were being interfered with by man for special breeding purposes.

Incidentally, Dr. Huxley mentioned that in such animals the maxilla generally advanced in a backward direction much more quickly than the mandible. Huxley did not mention the case of herbivora, where they did have another orthodontic problem, because there the mandible was lagging, and we had in those animals which chewed the cud a great deal of the chewing that was now being advocated among children, and they were being faced with two sides of a mandible which never occluded with the teeth of the upper jaw at the same time. He thought it was Miss Clinch at one meeting of that Society who wondered whether they were doing a wise thing altering the position of the mandible in certain cases for æsthetic purposes. In this connection he hoped that the Author

would give them one of the references he had mentioned.

In conclusion he expressed his deep appreciation of an immensely interesting lecture.

Mr. H. Watkin said that this learned paper had started with a mention of the orthodontic outlook. So many dentists took out teeth without the slightest idea of what the consequences of such extraction would be in two or three years' time. Before any tooth was extracted in the case of a child the dentist should reflect what would be the effect after a certain period. He should ask himself whether he must take out another tooth to prevent malocclusion occurring. Mr. Townend was in the unique position of having control of a large number of dental officers, and he was sure that he had imparted to them an orthodontic outlook.

The speaker mentioned that he had recently seen two boys—brothers—one of whom had the teeth pushed in on the right side and the other on the left side. On enquiry he found that one of them was left-handed, and his habit of resting his hand against his jaw had resulted in the mal-position of the teeth.

Mr. Chapman had suggested that to the Author's final sentence the word "permanent" should be added. He himself always taught in orthodontics two things, namely, that not only should the teeth be moved to the place where they wanted them to be, but they should be made permanent in that place. The permanency was just as necessary as the movement of the teeth.

Mr. Maxwell Stephens said the Mr. Townend had covered a very wide area and had put the subject in classical form for which they were much indebted to him. One of the great values of this paper was that they might be stimulated to do some reading for themselves.

He recalled that many years ago Mr. Montague Hopson read a paper on genetics, and it would be well worth while to look it up and consider the Author's views in relation to it.

Mr. J. H. Hovell said that possibly the most important points in this consideration was muscular mal-function in the production of orthodontic maladjustment. In his view mal-occlusion was chiefly dependent on two factors, namely, under-development and a wrong relation of the apical bases to each other. Mal-occlusion was determined by the action of the muscles of mastication and expression. When the upper apical base was not developed one of two unfortunate conditions might occur. One was a general overcrowding and rotation of the lateral incisors. In such a case the muscular pressure of the lip might prevent normal development and the lateral incisors might move forward. He thought that one had to correlate muscle pattern and apical conditions.

Mr. Townend had spoken of genetic and/or environmental effects. He would rather qualify environmental effects by the word "possible". Certain genetic factors undoubtedly formed the basis of mal-occlusion and environmental factors played a comparatively small part.

Mr. Norman Gray, after adding his word of thanks to Mr. Townend for a most stimulating paper, said that they were all encouraged when they had brought before them results of such wide-reaching importance. He had spoken of awareness and consciousness in diagnosing their cases. He thought that was to be emphasised in the right place. They should be aware of all the

factors entering into the causation of mal-occlusion. It would save a good deal of mechanical approach if they could increase their general knowledge and awareness.

He would like to know more about the constitutional type of which Mr. Townend had spoken. He had also said that he was making out charts. It would be a very great help to the Society if on some occasion those charts could be seen, so that members could go through them and fill in all the information about each case. The charting of the history of the case and of the heredity, environmental, and constitutional, would increase their knowledge, and make this paper even more profitable.

Mr. E. K. Breakspear said that the Author had raised a number of issues, but he desired to make only one small point. This concerned the need for facts and for measurements in scientific work. He spoke as one who was passionately fond of figures—perhaps being in the school dental service had something to do with it. But at the same time it was possible to have too much mechanisation even in orthodontics.

He felt that they must remember that orthodontics was not only a science but was also very much an art. They might find certain laws determining what was beautiful and what was not, but if one tried to produce a great painting only on mathematical principles it would lack the touch of the artist. Mathematics alone was not enough.

Mr. B. R. Townend, in replying first to Mr. Chapman, said that he quite admitted that his reference to a genetic factor in thumb-sucking was perhaps a little far-fetched ; but he did want to stress the fact that if one was treating a case of thumb-sucking it was valuable to have some idea of the basic cause behind the development of that habit by the child. The child was quite likely to have other habits as well—that is to say, to be a habit-type child. A considerable number of thumb-suckers, for example, had been found, who were also typical swallowers ; the two things seemed to go together very closely. Incidentally, in thumb-sucking, he had noticed a high proportion of children of dental surgeons who had sucked their thumbs.

Mr. Chapman had referred to diastema between the canines of the first premolar. This did definitely exist ; he had a number of models which showed it, and his own daughter had quite an appreciable space with a very regular mouth. It was a very interesting thing, and he could not explain it.

He thought that Mr. Chapman had misunderstood him when he suggested that leptoprosopes had small jaws. They did not necessarily have small jaws, but there was a tendency to a small mandible in relation to the upper—a tendency, at any rate, in that way.

Mr. Chapman had also questioned his remarks about the struggle between environment and heredity. But surely there was a constant struggle going on. The child was born into the world with a certain inheritance and it was immediately confronted with all sorts of environmental conditions, including diseases, habits, and so on, and often these in the case of the child who developed abnormally would produce mal-occlusion as well as other conditions in the body. The child was trying to develop into its own genetic normal and environment was in many cases doing its best to upset that complete development.

In reply to Mr. Aitchison the reference to Stockard's work that he wanted was "The genetic and endocrine basis for differences in form and behaviour." There had been one or two papers on this subject in the *American Journal of Orthodontics*. He thought that Leroy Johnson was the author of one of them. In Stockard's work the question had been treated from the dental angle. The question had been raised by some later speakers of the relative importance of genetics and environment. It was, of course, a balance between these two things which produced the end result. The works dealing with these different types were by Kretschmer and Sheldon. These had done the greatest amount of work in this particular field.

On the question of awareness, there was quite a lot of literature on the influence of the hypertonic mentalis muscle in connection with mal-occlusion, and he was inclined to think that that was an example of the failure to get at the root causes. This muscle had been accused of causing mal-occlusion. What happened was that the muscle went into vigorous action in the swallower, and its hypertonicity was taken as part of the typical swallower syndrome.

So far as the charts were concerned, he changed them every week more or less. They were not complete, and he was doubtful if finality would ever be reached. But it was useful to have some guidance of a diagnostic chart in orthodontics.

He agreed with the last speaker on the danger of mechanisation. Although he was a school dentist, he was afraid that figures meant very little to him. When he saw these articles from American sources with long columns of figures, he never read them, they did not mean anything to him. What he really wanted was some kind of yardstick which could be applied in the first diagnosis. He had mentioned in his paper Tweed's computation of the angle made by the flexure plane and the lower borders of the mandible. If one had something of that kind one could definitely say that if that angle was over 28 deg. (Tweed's figure) it was a definite indication that there was some lack of a downward growth factor in the development of the face. This did something to help, though it was not a yardstick. He fully agreed that orthodontics was an art as well as a science, and its æsthetic side must, of course, enter very largely into their work.

The meeting then terminated.



PRINCIPLES and CONSTRUCTION

of the ORAL SCREEN as a

FUNCTIONAL APPLIANCE

By

ROSAMOND CASELEY, L.D.S. (Edin.)

I have been much interested in the intensive research made by Warwick James (*Ref. 1*) in collaboration with Somerville Hastings into the important and common habit of so-called mouth breathing. They emphasized the fact that mouth breathing is a misnomer—that nasal respiration is common from early infancy even with children who habitually have their mouths open—and that those with the typical “adenoid facies” usually prove to be, in fact, open-mouth nasal breathers, and only supplement by mouth breathing when physical stresses make increased demand on respiration. Normally, lymphoid tissue is present in the nasopharynx and is a functional structure. It is only pathological when it has become infected or enlarged. After excision of adenoids by an E.N.T. surgeon the open mouth habit often persists.

They also stressed the existence of negative pressure in the mouth when the lips are closed and air and saliva are excluded by the act of swallowing. With this negative mouth pressure the action and position of the tongue, cheeks and lips are important factors in the correct moulding of the dental arches.

Development and relationship of the dental arches are dependent on growth and development of the whole facial structure, of which the maxilla occupies a major part. The maxilla is largely made up of air cells and, therefore, is greatly influenced by air pressure. With nasal inspiration and expiration there is negative and positive pressure in the nose and nasal sinuses (*Ref. 9*), this encouraging downward growth of the antra and palate.

The anterior sphincter of the oral cavity known as the Orbicularis Oris (*Ref. 6*) is made up of several strata of fibres—chief of these are the fibres of the facial muscles inserted into it—therefore, the open mouth is an indication, not only of lack of tone and function of the lips, but is associated with imbalance of all the mimetic muscles and of the anterior posterior chain of muscles: orbicularis, buccinator, pterygo-mandibular ligament, and superior constrictor of pharynx (*fig. 1* and *fig. 2*).

That the muscles of expression play such an important part in the moulding of the features has been recognized throughout the ages by the popular and much-abused practice of Physiognomy.

In his writings on Functional Growth of Bone which have been so excellently translated by Mrs. Lindsay, Franke (*Ref. 4*) states that growth of bone takes place in a direction at right angles to muscle tension. He claims that the powerful exertion of the facial muscles

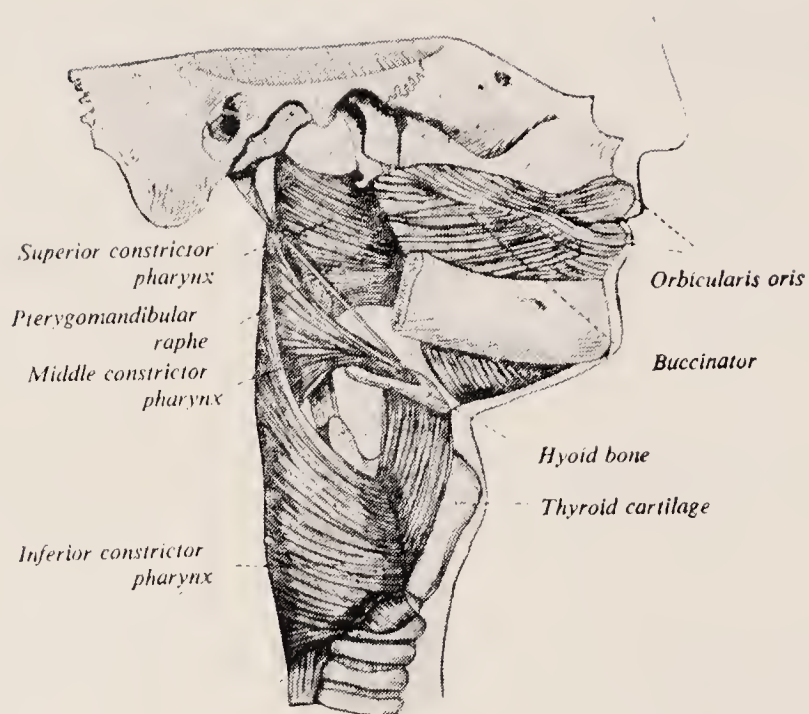


Fig. 2.—Showing ring of musculature surrounding the teeth formed by the orbicularis oris, the buccinator and the superior constrictor of the pharynx.

Hemley. "Fundamentals of Occlusion."

W. B. Sanders Co.

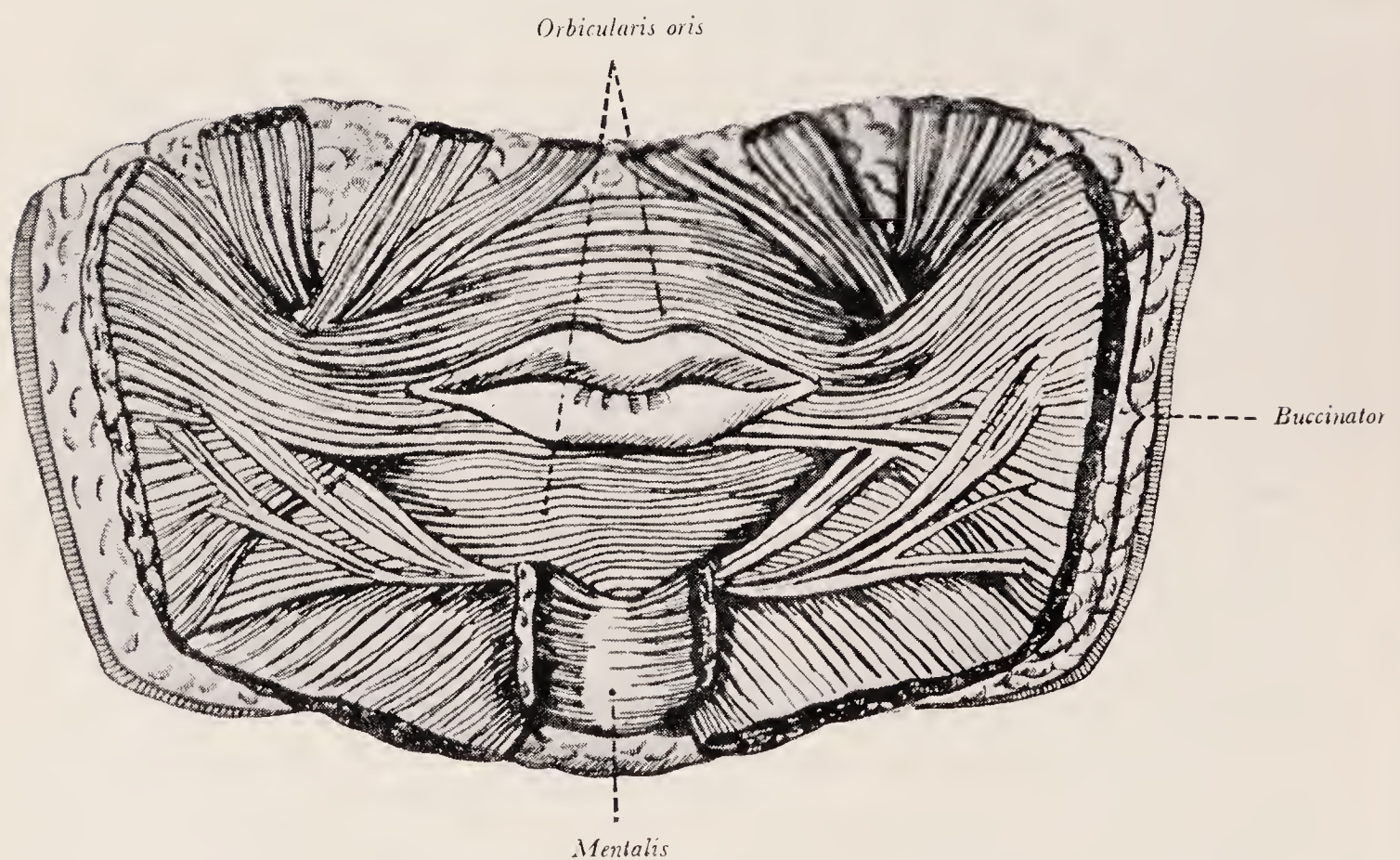


Fig. 1.—Showing the orbicularis oris merging with the buccinator muscles, and the intimate connection of muscles of expression with the orbicularis oris.—Hemley. "Fundamentals of Occlusion." W. B. Sanders Co.

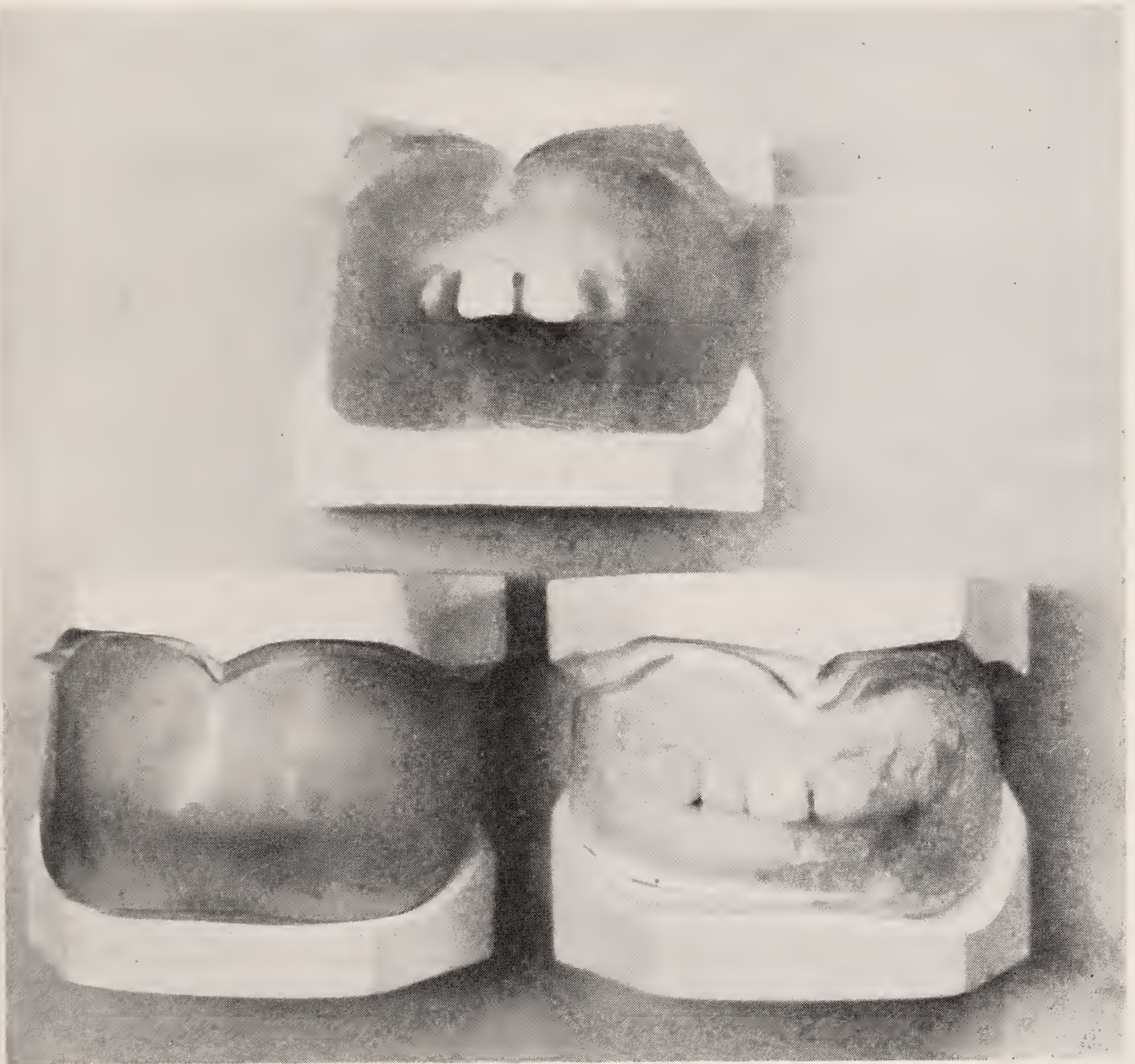


Fig. 3.—Showing stages of construction of screen for patient with post normal mandible.

Above : Models with teeth in natural occlusion are padded out with wax in buccal area and over lower sulcus.

Left : Screen is made of two-thicknesses of wax and contoured to line of buccal fold.

Right : Screen processed in clear acrylic.

for sucking and swallowing as well as for mastication has a formative effect on the facial skeleton.

Faulty lip pressure can exist in varying degrees in children. Those with slightly-parted lips usually have some deformity of the dental arches while, in this category, one encounters the type of class III malocclusion associated with lack of development of the middle third of the face (*Ref. 2*).

In the more severe open-mouth cases with sagging lips and stretched cheeks there is usually faulty facial development and the Class II, division 1 characteristics of the dental arches—narrowing of the maxillary arch through tension of the buccinators, protrusion of the upper incisors due to lack of restraining force of the lips, and the common forward positioning of the upper alveolar arch in relation to basal bone.

The tongue in these cases fails to play its full part in development. Also the mandible is obstructed in its normal forward development by the fact that with failure of the anterior sphincter and consequent loss of negative pressure in the mouth, gravity comes into play and the lower jaw is pulled down and backwards by weight of supra-hyoid, infra-hyoid muscles, the weight of the larynx and also by the depressed thorax associated with faulty breathing. Dart (*Ref. 5*), in his recent article on "Postural Aspect of Malocclusion," lays stress on these factors in orthograde man's poor adaption to posture, and emphasizes the pulling back of the mandible by the muscles inserted into the hyoid bone.

The postnormal mandible or micrognathia and consequent back positioning of the tongue are described by Robin (*Ref. 3*) in his *La Glossoptose* where he expounds convincing argument for correct facial posture and freeing of the pharyngeal airway for normal health and development.

This leads to consideration of the potentialities and effectiveness of the oral screen as a functional appliance.

For construction of the screen upper and lower impressions are taken extending everywhere to the line of buccal fold. The models can be articulated naturally or the lower can be advanced to normal anterior posterior relationship. The articulated models are then built out with wax where relief is needed—in the buccal area and over lower incisor teeth and lower sulcus.

The screen is waxed up of two thicknesses of pink wax to the line of buccal fold, extending as far as distal cusps of 6's and cut away from upper frenum. It is then processed in clear acrylic (*fig. 3*).

When inserted into the vestibule of the mouth the screen, by fitting loosely in the buccal area, will hold off the buccinator muscles and allow for expansion of the upper dental arch. It stands forward from the lower sulcus, and to avoid tipping of the screen by the mentalis muscle, the patient assumes a position of comfort by advancing the mandible (*fig. 4*).

With the frequent act of swallowing and the correct positioning of the mandible (*Ref. 8*) the tongue plays an important part by its contact with the hard palate and lateral expansion due to contraction of intrinsic muscles on the under surface. This was lucidly shown by Prof. Whillis in a recent paper given to the Society.

After swallowing, the mandible drops to position of rest (*Ref. 10*) and with the repetition of this act, there is intermittent action of



Fig. 4. —Above: Radiograph showing post normal occlusion of mandible.

Below: Radiograph of same patient with oral screen in situ, showing forward positioning of mandible.



Fig. 5.—Above: Patient, aged 12 years, is an open mouth breather and has lip-biting habit.

Below: Improvement in tone of facial muscles after nine months. Patient has worn oral screen in conjunction with upper Badcock plate.

the tongue, orbicularis-oris, and all the masticatory and mimetic muscles. Rogers (*Ref. 7*) has achieved excellent results with exercises for correcting faulty facial posture and malfunction of facial muscles.

The oral screen is worn by the patient at night and for a short period during the day, thereby stimulating intermittent reflex balanced muscle exercises for ten hours in twenty-four.

I should like to express my indebtedness to colleagues at the Eastman Dental Clinic who, by their broadminded approach to Orthodontics, have encouraged me to investigate the principles and possibilities of the oral screen as a functional appliance used alone or in conjunction with other appliances.

This investigation has stimulated my belief that Orthodontics, especially for prevention of anomalies, or retention after correction, should be approached from the physiological aspect as related to function and posture (*fig. 5* and *fig. 6*).

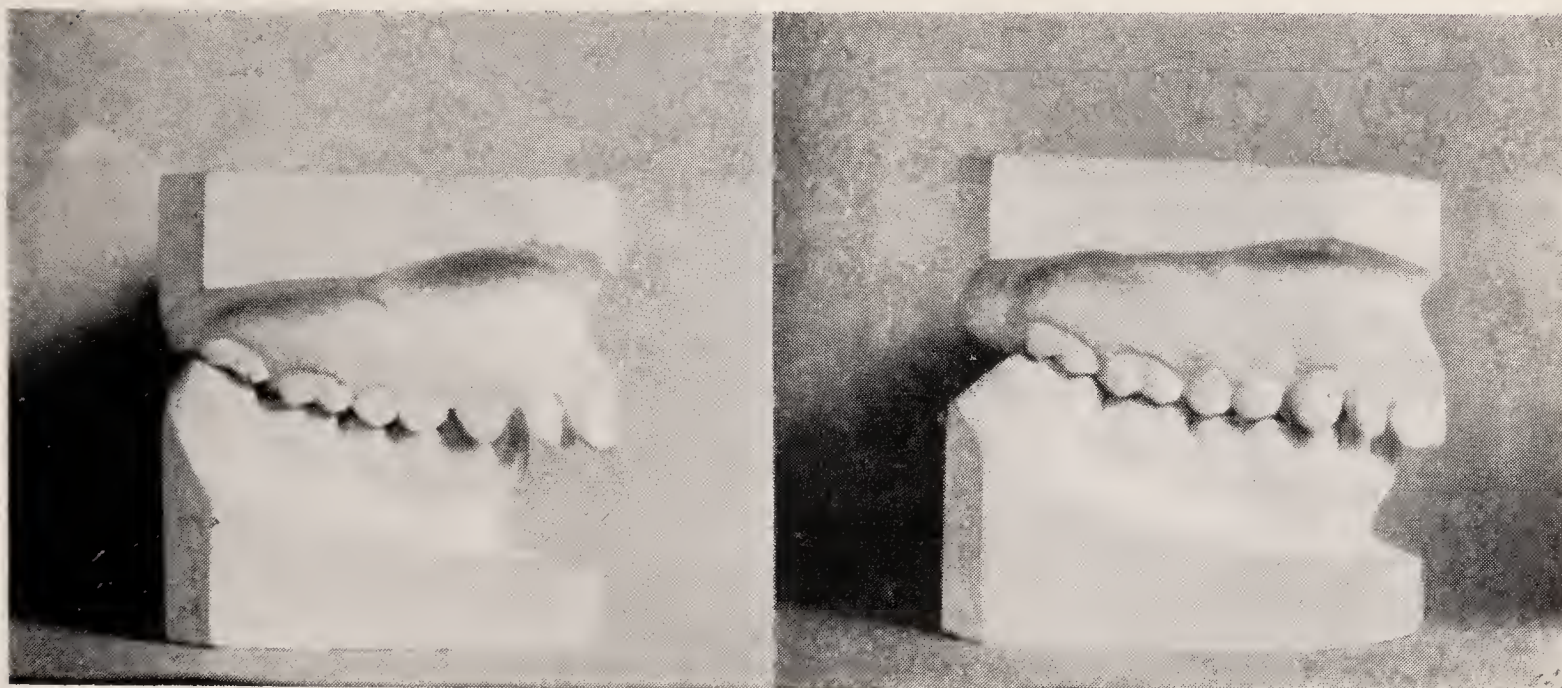


Fig. 6. —Study casts of above patient. Left: Before treatment. Right: After nine months.

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DISCUSSION

The President said that it was interesting to hear Miss Caseley stress the need for a loose fitting of the oral screen, particularly in the molar region, because that rendered it somewhat analogous in action to the Norwegian appliance, about which so much had been heard recently and in which looseness of fit was regarded as an essential feature.

In the references given at the end of Miss Caseley's communication he noticed the name of Dr. Sidney Leader, who was now closely associated with the development of acrylics. He believed that the article by Dr. Leader to which Miss Caseley referred dealt with a water manometer which actually showed the negative and positive pressures, with which Dr. Leader took some hundreds of observations in his private practice. It was interesting that an article written over ten years ago by a man who was now no longer interested in orthodontics should have some relevance to work which was being done by orthodontists at the present time.

Mr. J. S. Beresford said that he would like to thank Miss Caseley for her valuable communication.

The exact nature of the forces released by the oral screen was probably still a matter for speculation, but there could be no doubt that the screen effected a change that could readily be demonstrated and could be measured. During the past year he had been privileged to see a good many of Miss Caseley's patients at all stages of their treatment; she had let him go round the chair with a pair of compasses in his hand and watch what was going on. The oral screen was a very valuable appliance used alone or as an adjunct to other forms of appliance in many types of mouth breathing. He was looking forward with great pleasure to seeing Miss Caseley's contribution in print.

Miss D. J. Brown said that Dr. Holtz of Zurich obtained excellent results with the oral screen in cases of anterior open bite. He attached to the inner surface of the oral screen, by means of several strands of wire, a small flange, which prevented the tongue from being protruded between the upper and lower incisors. His results had been published in a book two months ago in Switzerland.

The President said that was strictly in accord with what was known about the insulation of the front of the palate by means of some form of barricade. The sucking of the tip of the tongue was a cause of anterior open bite, and the device to which Miss Brown had referred would prevent that.

Miss Brown agreed.

Mr. H. Chapman said he thought the Society was very much indebted to Miss Caseley for bringing before it the principles of the oral screen. He did not recall anyone having done that before.

Miss Caseley had given him the impression in her communication that she considered Class II, Division 1, cases to be due to open lips, mouth breathing, and so on. He did not know whether she had intended to give that impression. It seemed to him that the open lips and the Class II, Division 1, and all that went with it were part of the same syndrome and were not cause and effect.

Mrs. Michaelis said that there was one small practical point she wished to mention in connection with Miss Caseley's very

interesting communication. She had been using oral screens for some time, but she had not been able to avoid the occasional complaint that the child was apt to wake up with the screen at the bottom of the bed. She would like to know whether that was due to a fault in the construction of the screen or whether Miss Caseley found that the same thing happened in the case of her patients.

Mrs. M. C. Strange said that she had the same complaint from her patients, but she nearly always found that after the children had worn the screens for a certain length of time they became used to them and the screens stayed in their mouths all night.

She had found the oral screen very useful since she had been dealing with a large number of patients. A great many of the children in a clinic came in with posterior teeth missing, and the oral screen was a very useful appliance to insert in cases of Angle's Class II, Division 1, whilst one was waiting for those teeth to erupt. The results obtained in such cases with the oral screen were sometimes surprisingly good.

Professor H. H. Stones said that he was not an orthodontist but he had been very interested in Miss Caseley's communication and would like to ask whether she found any improvement in the gingival condition from the wearing of an oral screen. It was well known that mouth breathers tended to develop gingivitis.

Mr. R. E. Rix thought he was right in saying that, although Mr. Warwick James and Mr. Somerville Hastings found that there was a negative pressure established between the dorsum of the tongue and the palate, Mr. Thompson in America had contradicted that assertion. It was a fact, however, that there was a negative pressure between the dorsum of the tongue and the palate for about 100 to 120 seconds after swallowing; after that the dorsum of the tongue normally fell away from the palate.

Mr. O. Henry said that he used the double oral screen to develop the nasal pharyngeal passages, and the patient wore it all night.

Dr. C. C. Cook said that about the year 1935 he had been associated in New Zealand with Mr. H. Maurice Peacock, who had seen a communication on the subject of oral screens by the late Mr. Dickin in the *Journal of the Royal Society of Medicine*. Mr. Peacock and he did a good deal of work on oral screens after that and they had been amazed at the expansion which they obtained in many cases. They could not understand it or work out the theory of it. Recently he had been in Dublin and had been surprised to hear Dr. Friel say that the pressure exerted by the buccinator muscle was practically nothing, as Dr. Friel demonstrated with the manometer.

Mr. Henry said he had seen the very fine work which Mr. Dickin had done in the expansion of arches.

Miss Caseley, in replying to the discussion, said she was interested in Miss Brown's remarks about the device for preventing the tongue thrusting in the anterior open bite cases. She found that those were the cases in which she could not achieve success with the ordinary oral screen. A child with an anterior open bite who wore an oral screen thrust the tongue through, and there seemed to be a great deal of salivation and no beneficial effect from the wearing of the screen.

She was inclined to agree with Mr. Chapman that the Class II, Division 1, characteristics and the open mouth were part of the same condition, but she believed in the functional growth of bone and thought that the two occurred at the same time, as Franke emphasised. She thought that with correct posture proper development was obtained at the same time. It was very difficult to say which was cause and which was effect.

With regard to Mrs. Michaelis's question, she thought that if the screen came out at night it was due to faulty construction. The screen should be taken fairly far back in the mouth, to the cusps of the six year old molars. It was also a help if the child learned to wear the screen by wearing it for at least an hour during the day.

She was interested in the remarks made by Mrs. Strange. She had taken over many of Mrs. Strange's patients and knew that Mrs. Strange was obtaining very good results by the use of the oral screen.

With regard to gingivitis in mouth breathing, she thought there was an improvement when the child was taught to keep its mouth closed. A very interesting factor was the common occurrence of tension ridges in the open mouth breather. Mr. Warwick James had called her attention to the hard line of hypertrophied tissue round the necks of the upper incisors, showing where the pressure of the lips came down and where it failed. She thought that was a forerunner of gingivitis.

With regard to Mr. Thompson's work, to which Mr. Rix had referred, Mr. Thompson got the patient to swallow a very fine chain and then took X-ray photographs, and he proved that the tongue was in complete contact with the palate for, she thought, one second after swallowing.

Mr. Rix said it remained up to a minute and then fell away.

Miss Caseley, continuing, said she was very interested in Dr. Cook's remarks. She had read the articles that he had written as a result of the work he had carried out with Mr. Peacock and had learned a good deal from them.

She knew that Professor Friel claimed that the tension of the muscle did not cause deformity, and Franke agreed with that, but she thought that proper development occurred from the time when proper function and proper balance of muscles were secured.

The meeting was then terminated.



DEMONSTRATIONS

CASES FROM THE SCHOOL CLINICS

by

Miss E. M. STILL, L.D.S. (Eng.)

1. *Class I.* Upper incisors lingual to the lower ; Fig. 1. Treated with a fixed appliance, Fig. 1a shows lingual aspect.
2. Protrusion of upper incisors caused by thumb sucking continued until 8 years of age. Fig. 2, 2a. Habit checked and condition improved by use of oral screen Fig. 2b.
3. *Class II* First permanent molars lost on account of caries ;
Division I Fig. 3, 3a. Treated with intermaxillary traction.
4. *Class I.* Lack of growth in premaxilla ; Figs 4, 4a. Treated with fixed appliance, rotating 6 | 6 and moving 21 | 12 forward, making room for all premolars. Fig. 4b shows type of appliance used in treatment.
5. *Close Bite.* Figs. 5, 5a. Treated by removable appliance with deep biting platform Fig. 5b, and lingual spring Fig. 5c.
6. *Class III* Treated by intermaxillary traction, Figs. 6, 6a.

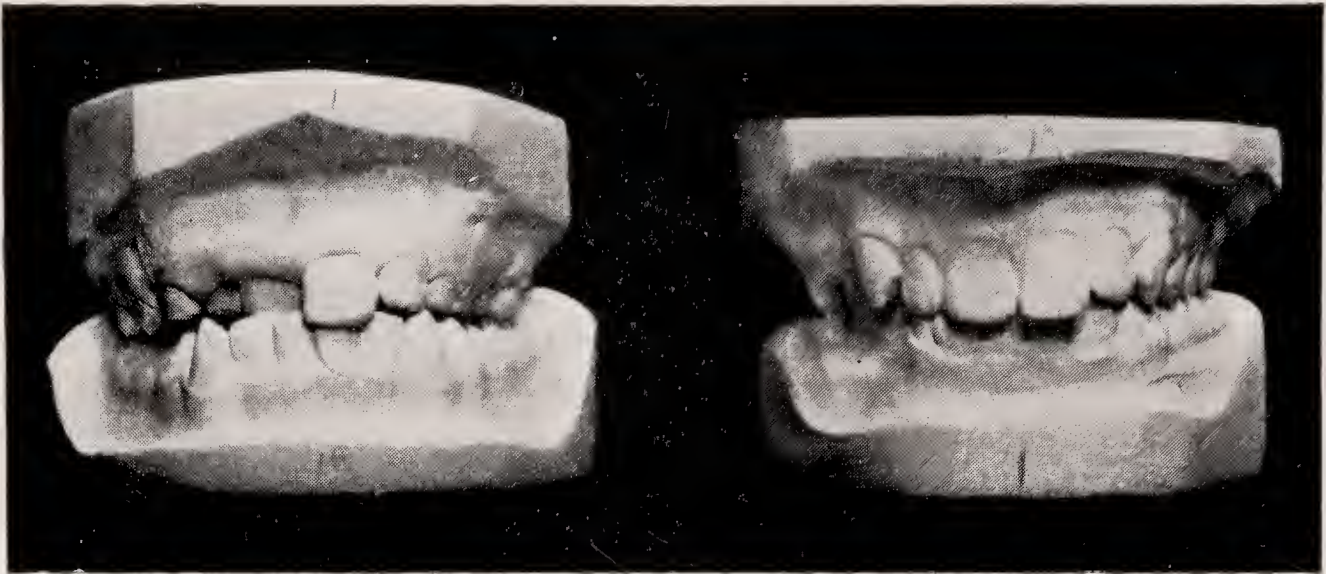


Fig. 1

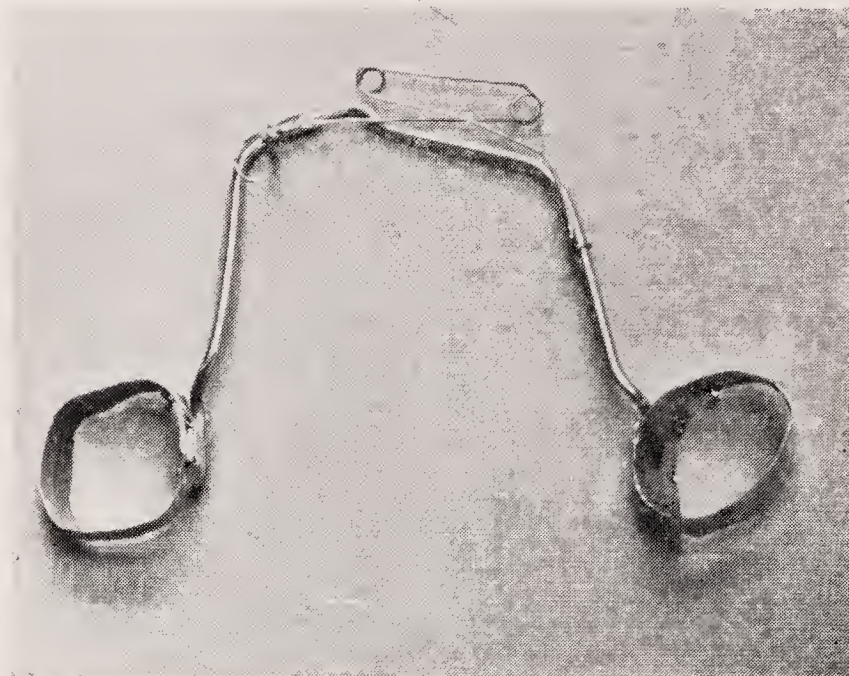


Fig. 1(a)

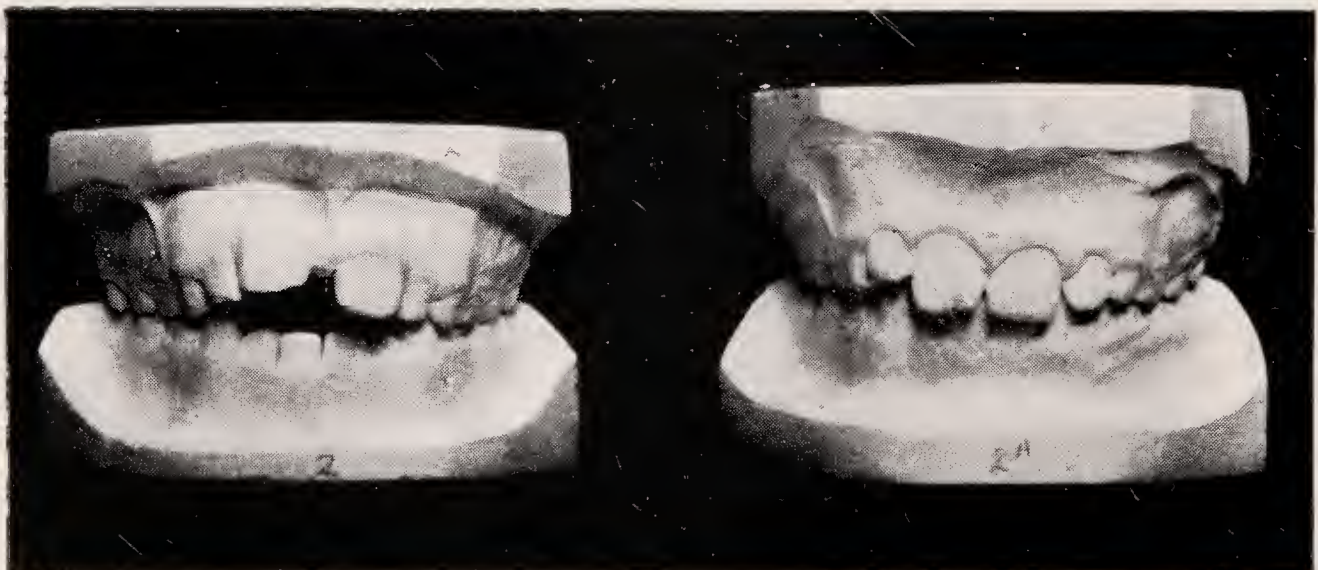


Fig. 2

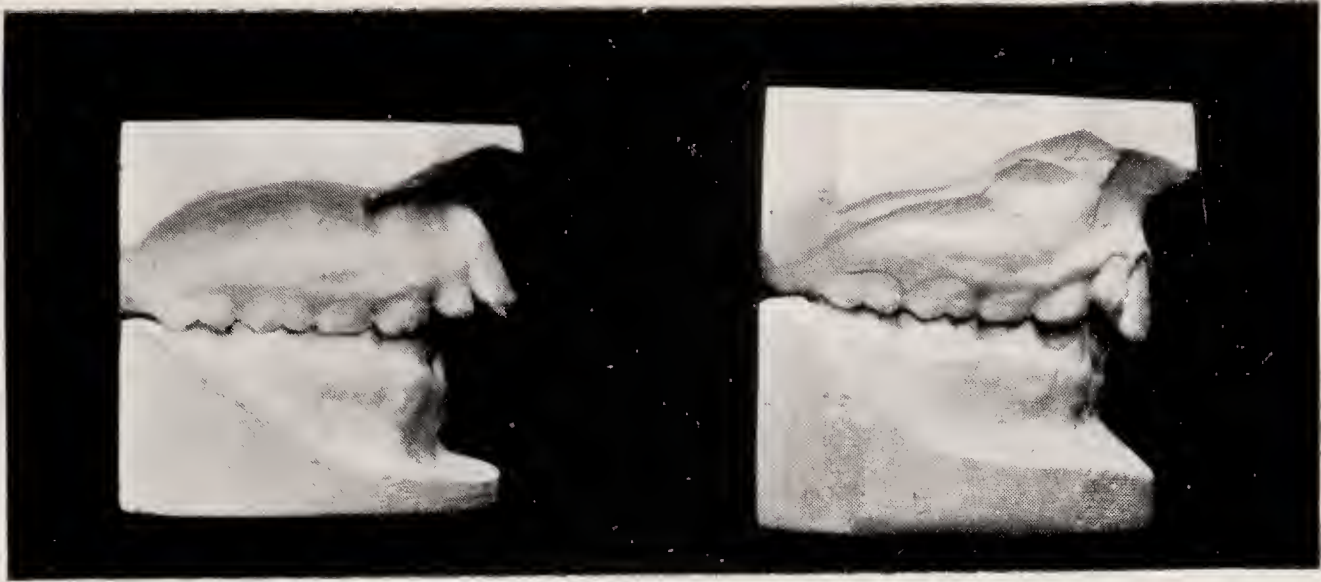


Fig.
2(a)

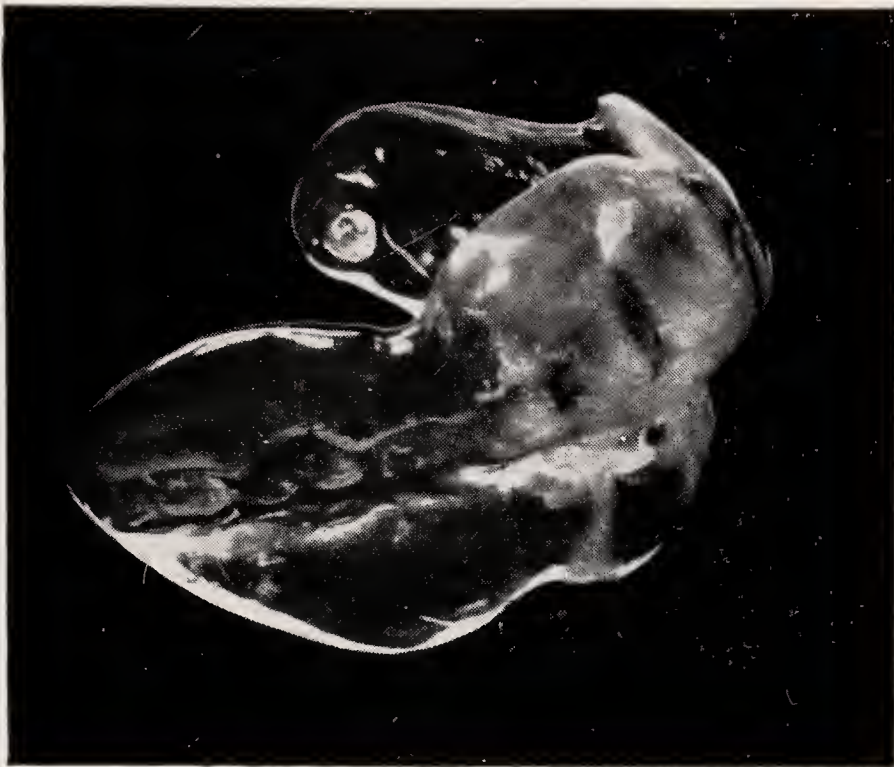


Fig. 2(b)

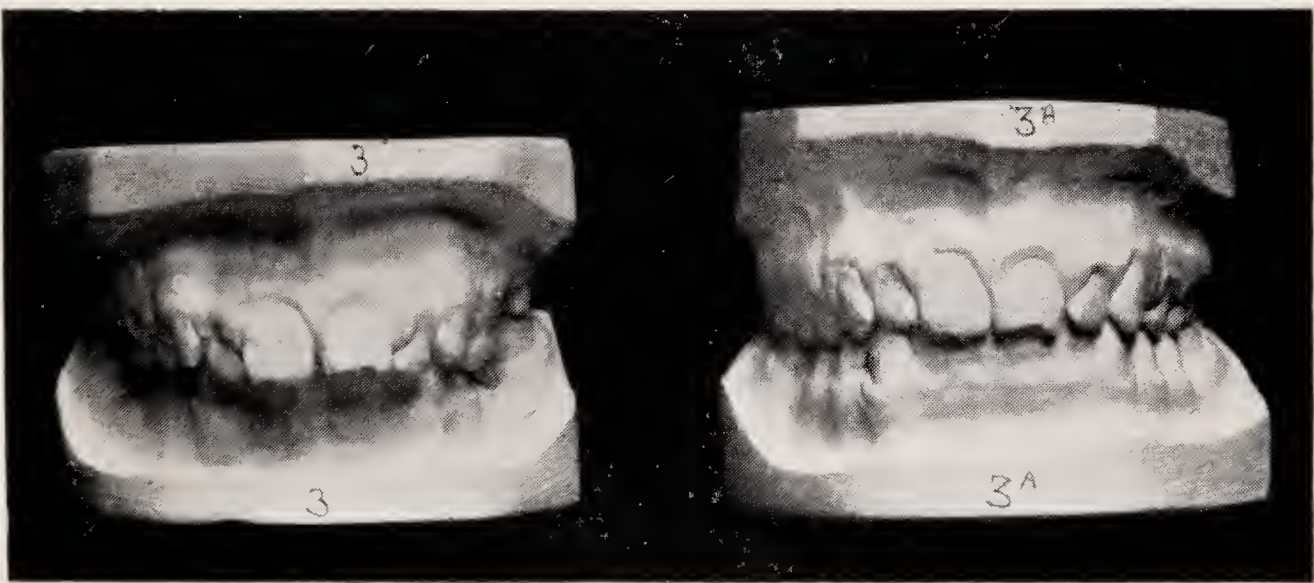


Fig.
3

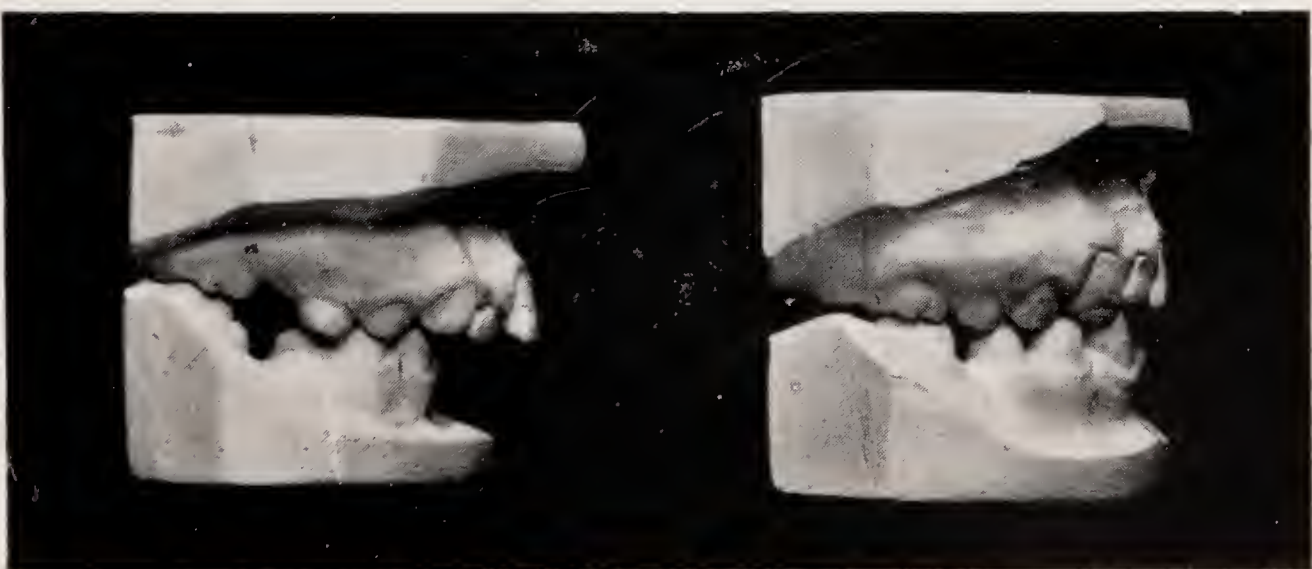


Fig.
3(a)

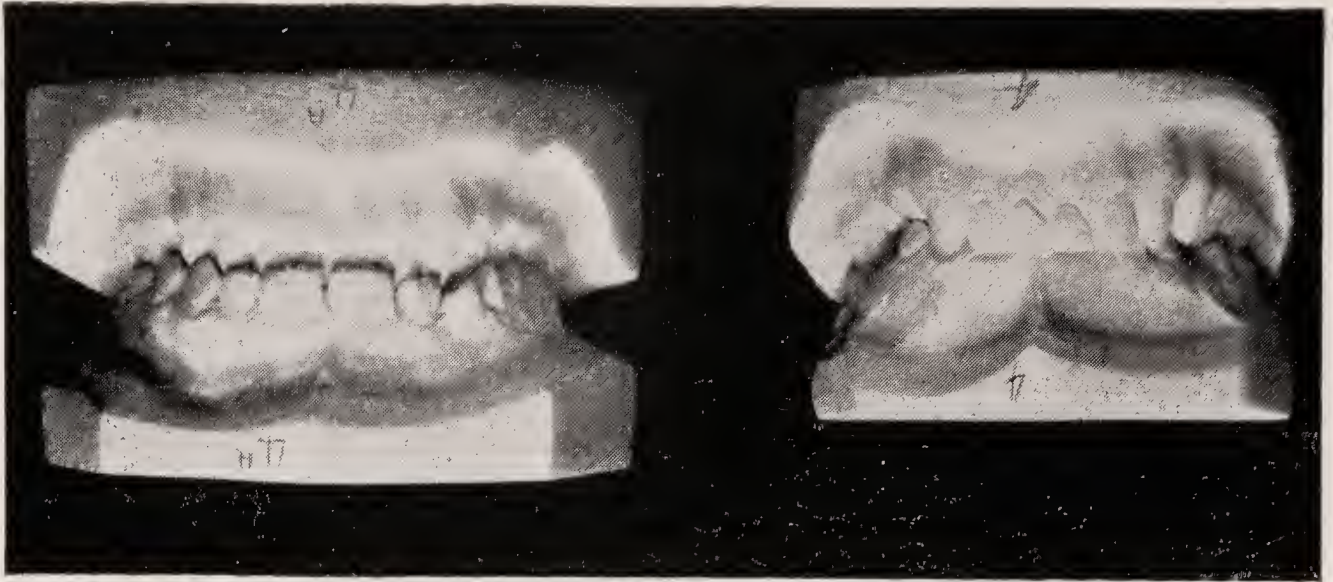
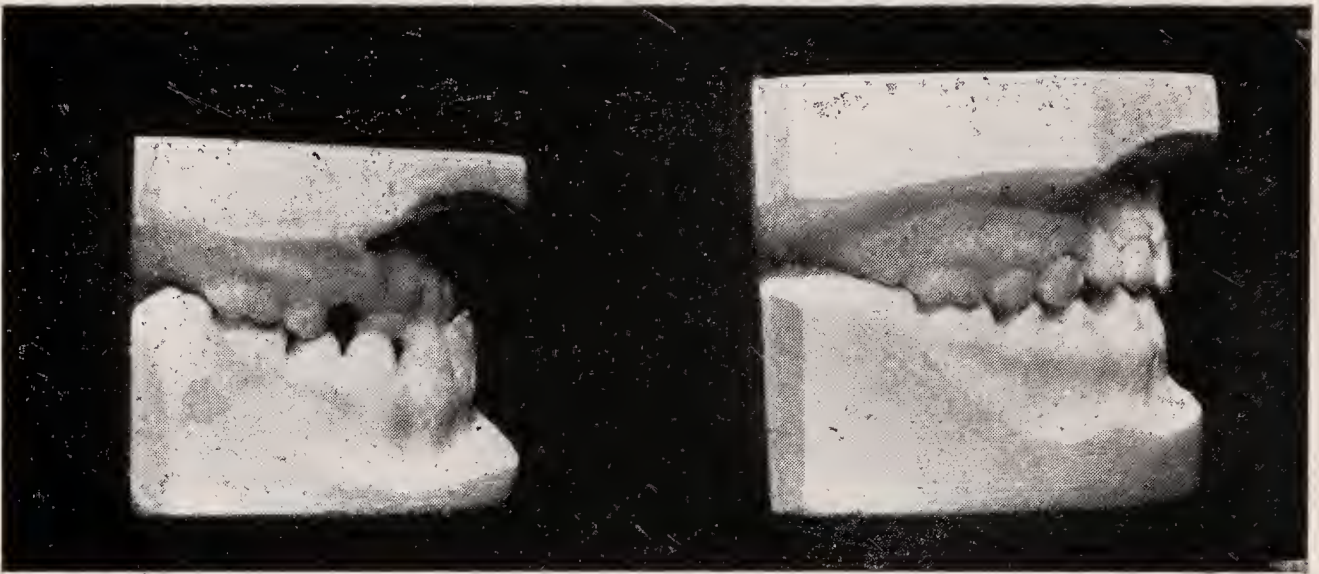
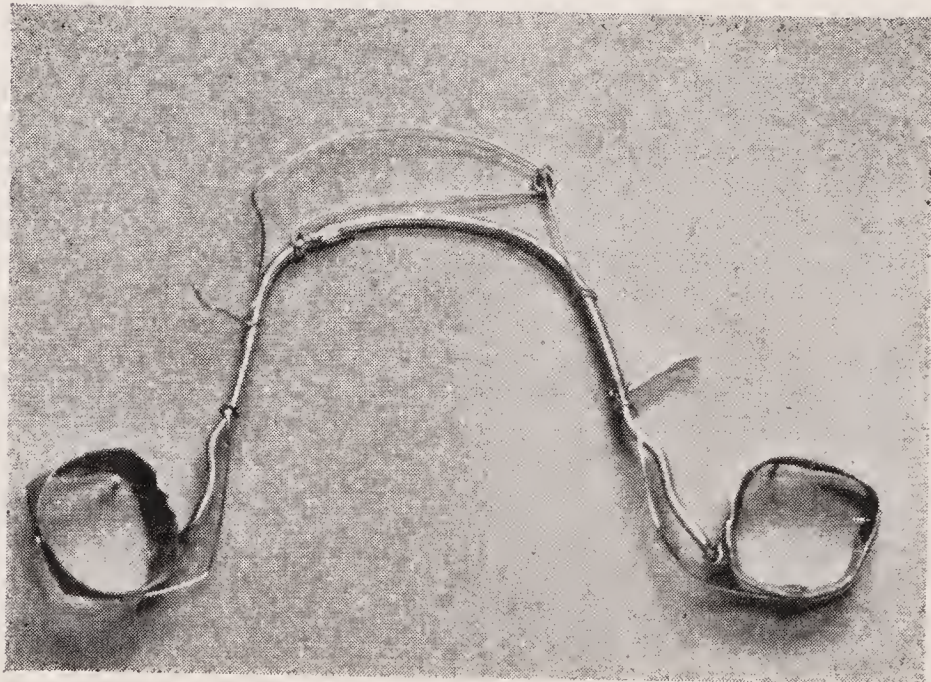
*Fig. 4**Fig. 4(a)**Fig. 4(b)*



Fig. 5

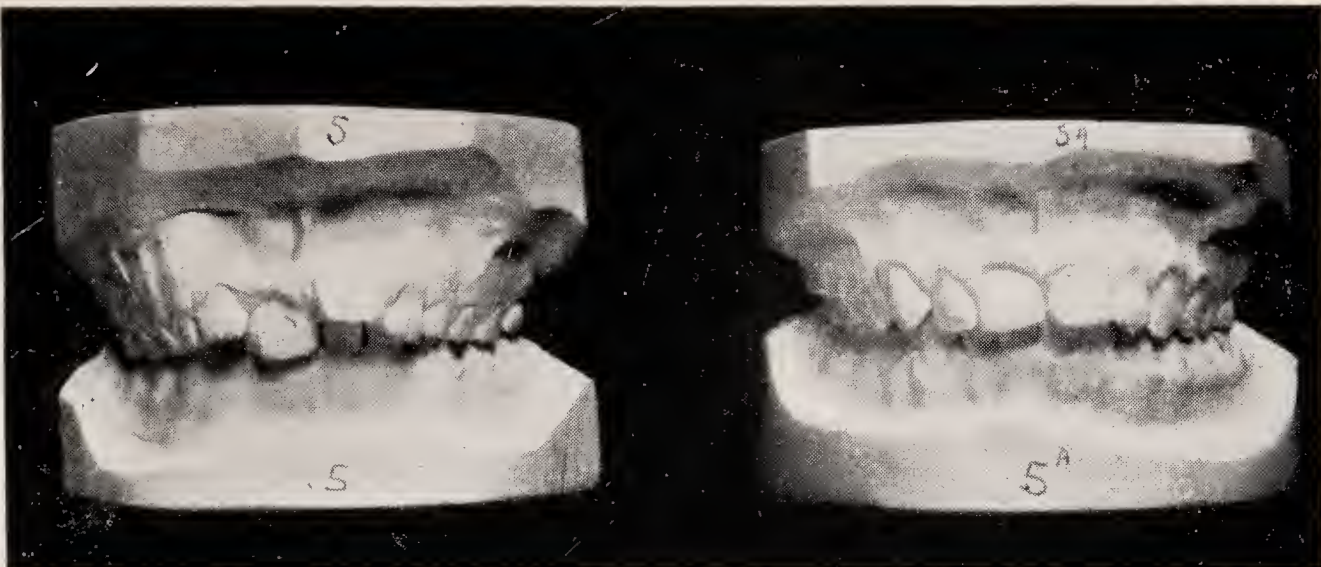


Fig. 5(a)

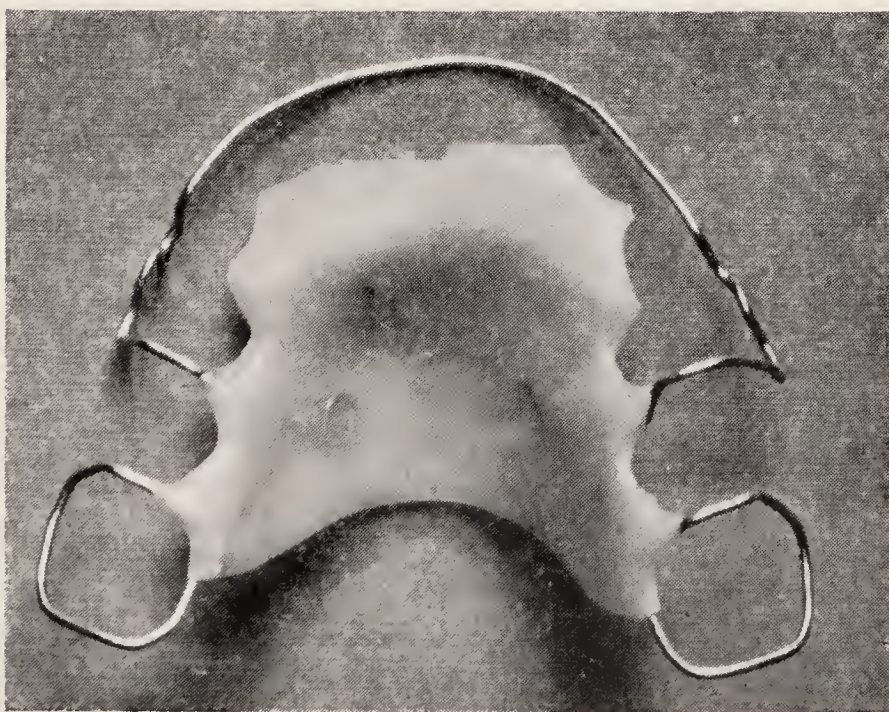
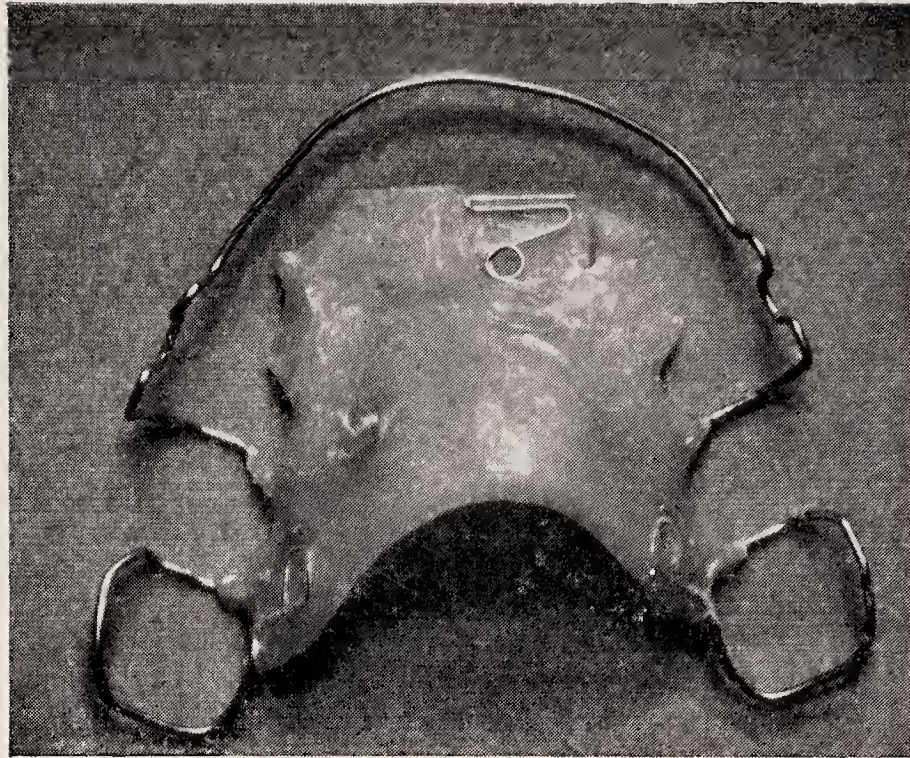


Fig. 5(b)



5(c)



Fig. 6



Fig. 6(a)

TWIN ARCH TECHNIQUE

By

J. S. BERESFORD, B.D.S., H.D.D.

The basic principles of the twin arch mechanism were demonstrated using only stainless steel materials. The components of the appliance were shown separately and models illustrating the assembly of these to bring about all types of tooth movement were on view.

In lieu of the locking device of J. E. Johnson which is difficult to obtain here just now a "W" lock necessitating the use of ligatures or soft wire staples was used. The locks were pressed from 0.15 mm. tape by means of special pliers and spot welded to the anterior bands.

Accessories such as mandrils for making coil springs, a core for wrapping staples and a wire measuring device were displayed as important time saving factors in work of this nature.

Patients models prepared from impressions taken before and after six months of treatment were on view. These had been selected to illustrate the tooth movements possible with the appliance.

Attention was drawn to the following dental literature ;

<i>A. J. Ortho.</i>	April 1941.	J. E. Johnson.
<i>A. J. Ortho.</i>	June 1943	Dolce Barber, Eby, Porter and Madden.
<i>The Dental Record</i>	Jan. 1946	B. R. Townend.

NIGHT TIME APPLIANCES

By

S. G. McCALLIN, L.D.S.(Eng).

"Night-time Appliances," consisted of a series of models of different cases with plaster and stainless steel removable appliances, all designed to be worn only at night. The majority of the appliances were representative of the group which have been demonstrated by Prof. Schwarz of Vienna. In addition to these, Dr. Sved's bite plane retention appliance and the adaptor recently described by Dr. Kesling were also shown.

It was specially demonstrated that Class II traction for the correction of post-normal mandibles, can very readily be carried out using elastics attached to removable appliances worn only during the night.

PRESS BUTTON PLATE AND FINGER SPRINGS

By

H. C. VISICK, L.D.S.(Eng.).

The fundamental idea is stability of the plate in the mouth, enabling the use of very fine finger springs. This demonstration illustrated the use of lingual spurs and partial cribs to ensure very definite retention. The spurs were made of flattened, stainless steel wire ; the free-ended cribs which only gripped the tooth at the cervical margin were knife-edged, so as to slide between the gum and the tooth. The crib not being continuous round the tooth and being free-ended, can be adjusted to any position.

Finger-springs.

These are made of 0.35 mm. wire and 'boxed-in' on the palatal surface of the plate, enabling them to move freely, and are protected from mastication.

THE SPLIT ARCH APPLIANCE

By

J. W. SOFTLEY, B.D.S.

The appliance is a lingual apparatus designed to produce a differential expansion of the arch. (Fig. 1.)

The two halves of the arch wire are freely moveable and do not bind the anchor teeth rigidly.

One auxiliary spring is used to activate the appliance and because it is acting on a number of teeth, usually six, it can be of considerably larger gauge than normally used with less liability to damage.

The main arch-wire keeps pace with the expansion and so interferes less with tongue movements.

By altering the curvature of the transverse portion of the appliance any variation in the expansion of different parts of the arch can be accomplished. This curvature must be determined for each case and the significant factor is the location of the centre,

With the centre between the two anchor teeth virtually no change takes place in width at this part of the arch, but expansion is progressively greater towards the front. Rotation of the anchor teeth is effected (Fig 2). If expansion of the anchor teeth is desired as well the centre is moved back (Fig. 3).

When the centre is at infinity the arc becomes a straight line and equal expansion is obtained of all parts of the arch without rotation of the anchor teeth.

If the centre is moved in front of a line joining the anchor teeth a reduction in the width between them will be caused as the appliance functions (Fig. 4).

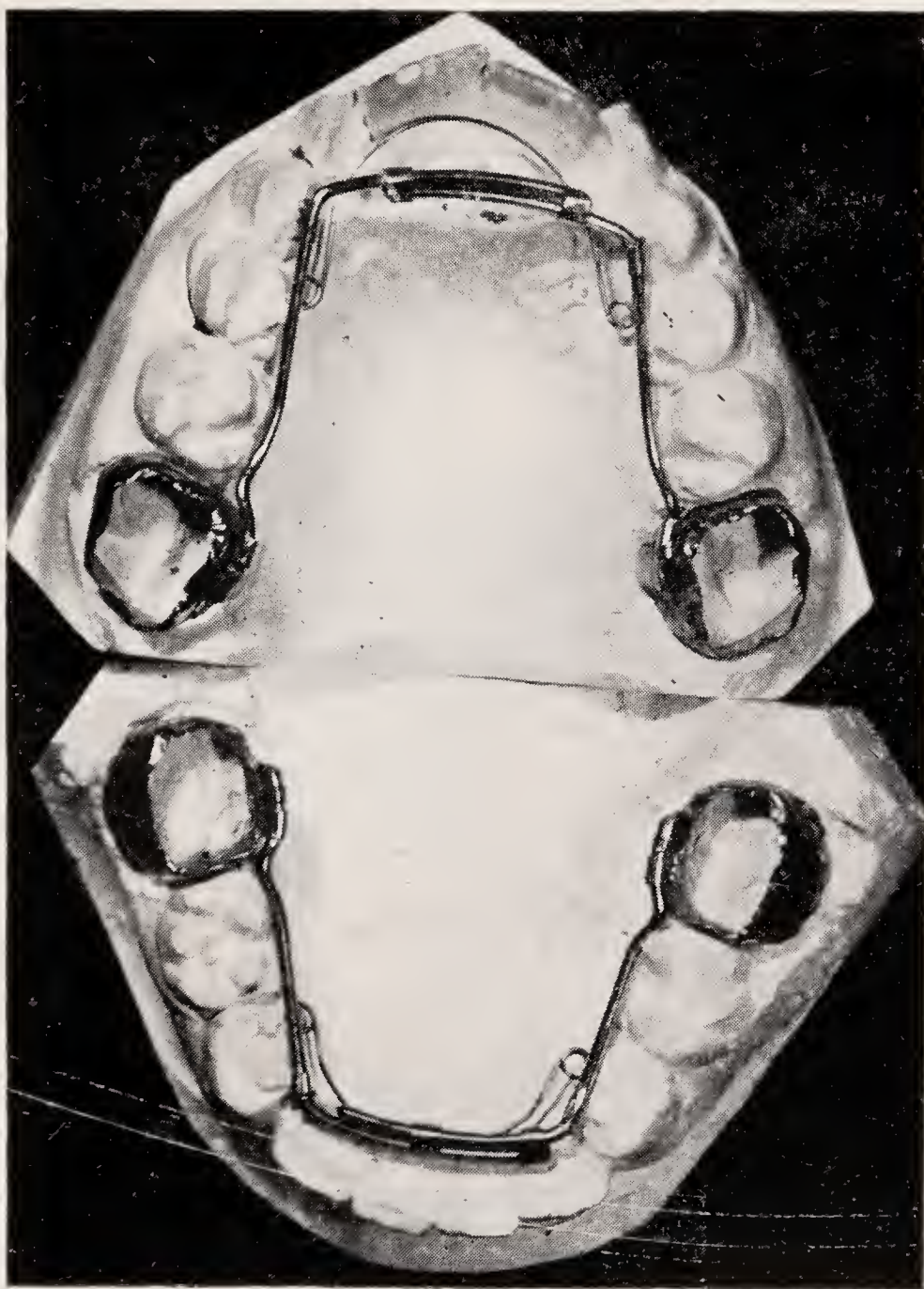


Fig. 1

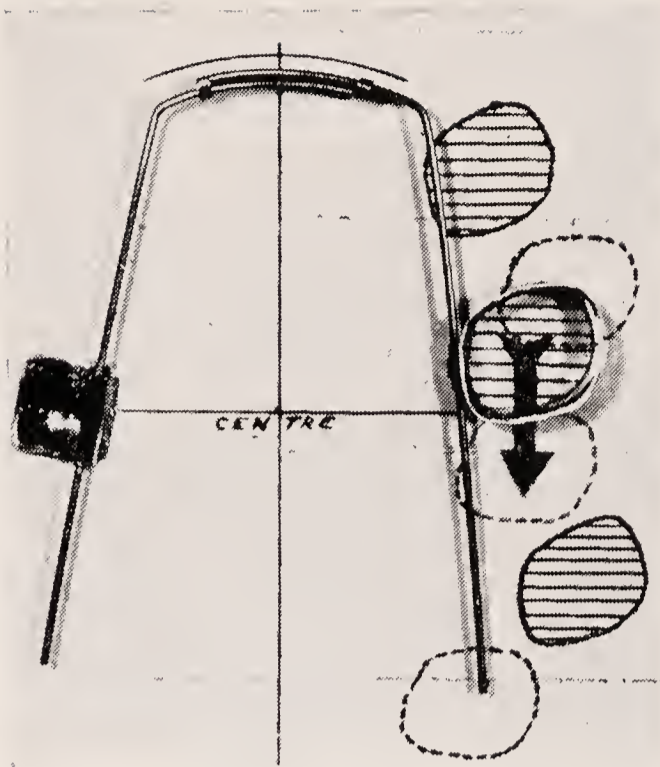


Fig. 2

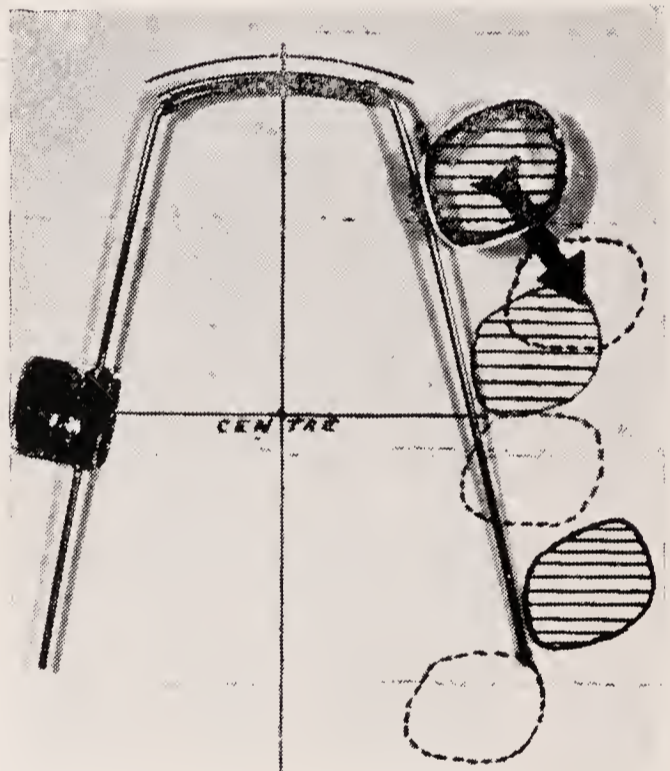


Fig. 3

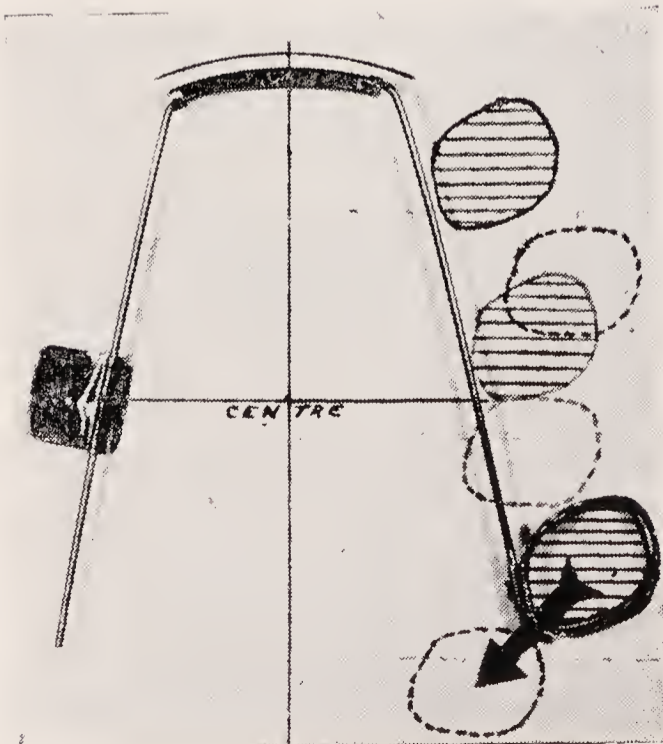
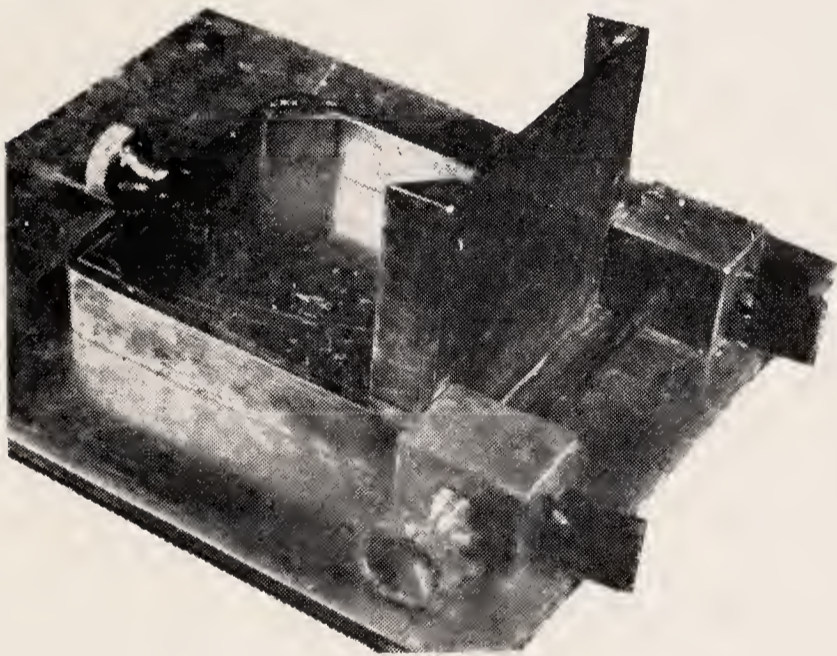
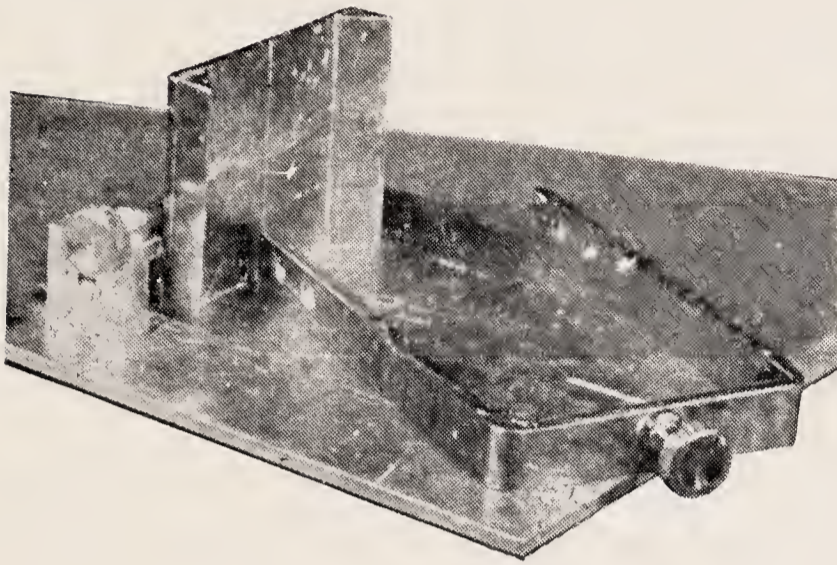


Fig. 4

A MODEL FORMER

By

W. GROSSMANN, M.D. (Prague), L.D.S. (Eng.)



The use of a simple orthodontic model former first described by Viggo Andresen. The model former (Fig. 1 and Fig. 2) consists of a metal base plate to which is fixed a vertical metal plate. In the midline of this plate, a shallow vertical groove is present, which helps to indicate the midline of the model. The edges of the metal plate are bound by two vertical bars, cut back 45° . Lying on the base is a metal frame, the anterior part of which is corresponding in size and shape with the inner surface of the vertical plate, and also carries a vertical groove in the midline; each arm of the metal frame is drilled with two holes. With the help of a locking bar, these metal frames can be fixed to the base, as well as to the vertical plate. Models are obtained by casting the impressions first in stone or plaster. The metal frame is then assembled as seen in

Fig. 1 (Upper)

Fig. 2 (Centre)

Fig. 3 (Lower)

Fig. 2. The base bound by the metal frame is filled with soft plaster, and the upper cast model is pressed into the soft plaster. Care must be taken to see that the midline of the model corresponds with the metal groove on the anterior surface of the vertical plate and the groove on the metal frame. The occlusal surface is set parallel with the base plate.

When the plaster is set, the metal frame is removed, and the upper model is completed.

The lower cast model is now fixed to the upper with the help of some sticky wax. The model former is assembled again; the metal frame filled with plaster, and the lower model is pressed into it. The upper model is used as a guide, its posterior surface sliding along the vertical plate (see Fig. 3).

A pair of models is thus obtained, which has the size of $7 \times 7 \times 7$ cm.

The gnatho-physiognometer of Andresen can be used in conjunction with this model former (Fig. 4 and Fig. 5). The use of gnatho-physiognometer is demonstrated in Fig. 6.

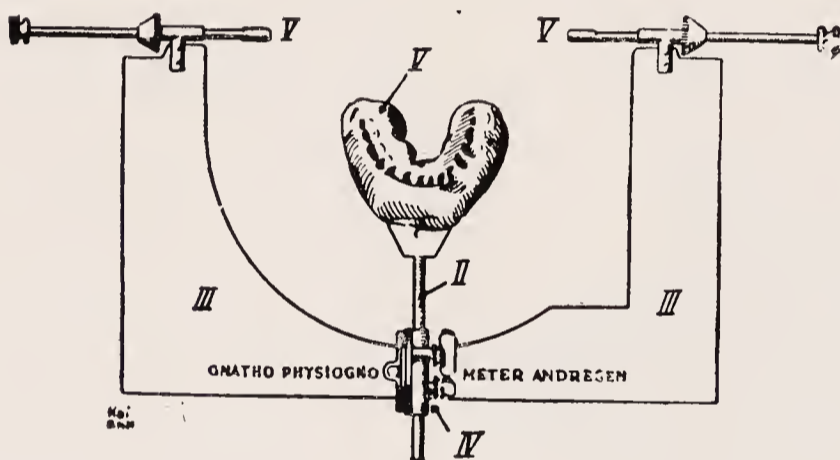


Fig. 4

Fig. 5

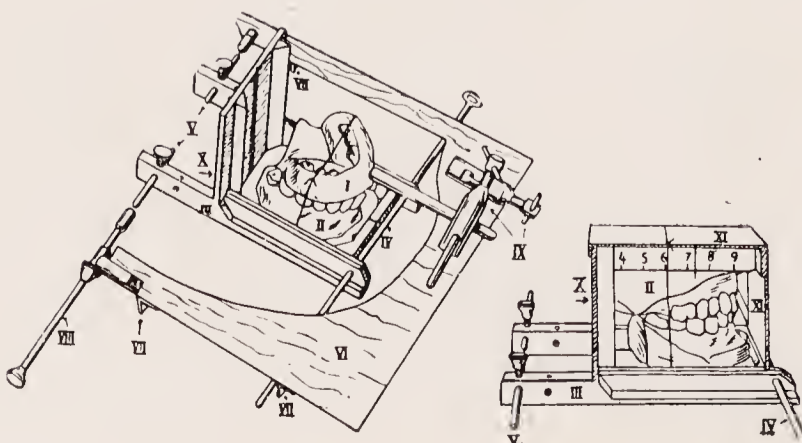
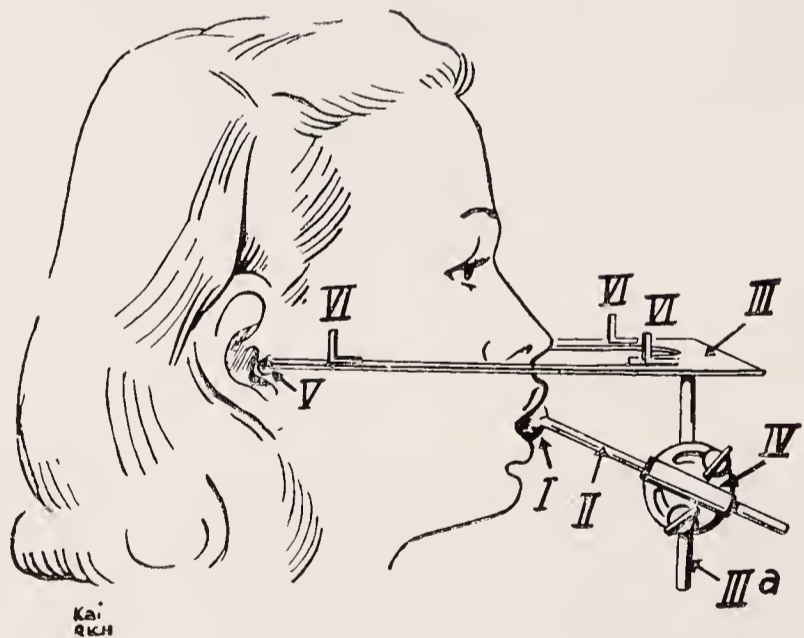


Fig. 6

—ORTHODONTICS—

ITS NATURE AND OBJECTIVES

By
ANDREW FRANCIS JACKSON,
D.D.S., F.I.C.D.

The nature and scope of orthodontics is such that its objectives can only be estimated on a qualitative basis and the methods of attaining them, by employing principles of procedure of universal application. In the light of absolute reality there is no other possible method of dealing with the problems of infinite variation either scientifically, philosophically or artistically.

The objectives of orthodontic treatment are fortunately simple enough to state and understand. They are:—

1. A satisfactory proportion of bony development to tooth substance, which can be termed structural balance.
2. An arrangement of the teeth and bones which will permit of a satisfactory excursion of the mandible. This can be termed functional efficiency.
3. A satisfactory proportion and orientation of the dental organs to the other facial factors in order to present a pleasing appearance, which can be termed æsthetic harmony.

There is no exact scientific means of measuring any of these objectives, and the responsibility of deciding what they should be for any specific individual lies squarely on the judgment of those who have the temerity to undertake the dangerous job of altering the original plans of nature. The stupendously complex factors of life which come under the headings of heredity and environment determine the exact physical and mental qualities of every individual—whether they be satisfactory or not. They terminate at least in a state of fairly stable balance.

Orthodontic practice consists in disturbing these original plans of nature in order to produce more desirable functional and æsthetic arrangements which will again remain in a state of balance. The methods employed may be both natural and artificial, and depend for their success on the creative imagination and inventive ingenuity of those who employ them. Treatment is, in most cases, a compromise with nature.

Every practising Orthodontist is primarily interested in the successful results of his own cases, and in a broader and more altruistic way, of contributing something of permanent value to the progress of orthodontics.

The most interesting and direct way of presenting concepts and methods of procedure is by means of case reports. Case reports are to the Orthodontist what paintings are to the artist, by which

the scope of his imagination and skill in execution can be demonstrated and evaluated. They don't necessarily have to be good to be interesting. They should at least be mentally provocative.

If it were mandatory that all essayists should demonstrate their opinions by showing some practical results, a lot of tiresome platitudinous twaddle would be eliminated from orthodontic gatherings.

Case reports mean nothing at all unless they represent the intelligent and logical application of basic principles which are applicable to all cases, regardless of what the particular disposition of the teeth, relation of the jaws, and other factors may be. There is probably nothing more fatal to good orthodontic treatment than employing methods or viewpoints which inhibit the capacity for visualizing problems in their entirety.

Before deciding upon any form of treatment, mechanical or otherwise, every case of malocclusion requires that several decisions of vital importance be made by the orthodontists. The final arrangement of the teeth is determined by the structural and functional limitations of the individual, and not by any preconceived idea of normality, which cannot be definitely estimated for the individual in terms of the average of a group.

Plaster models are but artificial replicas of very circumscribed areas, and convey a very slight idea of the dynamics of function of the individual from whom they are taken. Per se, they can be very misleading in conveying to the operator the actual facts upon which he should be informed. Orthodontics is concerned with combinations of form and functions from start to finish.

Obviously the ideal way to gather the vital data necessary is from a personal study of the actual individual, both in repose and in function. In this way alone can a correct estimate be gathered of not only the gross factors of structural proportion, muscular tensions, and mental capacity and control, but also all the idiosyncrasies of function and personal interest of the patient, so important to successful treatment.

This leads to the first general principle of treatment which is so far-reaching in its importance that its value can hardly be over-estimated.

The first step in studying any type of malocclusion, is to direct the patient to occlude the jaws in the position which, from every standpoint, appears to be the most desirable. Alfred P. Rogers termed this the position of Occlusal Advantage. This immediately discloses, in the simplest and most revealing manner, the exact condition of affairs, and shows just what the interferences are which prevent the patient from occluding in that position habitually. At this point the true orthodontist should allow, as far as possible, the most complete freedom of action to his intellectual, artistic and intuitive faculties, tempered at all times by his common sense, clinical experience and observation.

These interferences may be malpositions of certain teeth in their horizontal relationship, their anteroposterior relationship, or their vertical relation or any combination of these. In some cases the first immediate interference may be the simple torsoversion of one tooth. After this has been thoroughly studied, the first logical step in treatment should be to devise means to remove the interference, and this should be accomplished with appliances best suited to the

peculiar requirements of that particular individual case and at that particular moment. In the natural order of things, concepts come first, general principles of treatment second, a consideration of the factors involved third, and finally, the type of appliance to be used for the particular case. The great ingenuity of orthodontists has produced a vast variety of appliances, and it is the job of the orthodontists to select from this material the ones best suited, not only to the particular case he is going to treat, but to the particular problem he is presented with.

The second general principle is that as action is followed by reaction, and accompanied by interaction, a complete revaluation of the case should be made at each visit of the patient, and that the nature of the next step in mechanical interference should depend entirely upon the new set of conditions which the previous treatment has produced.

The third general principle is to consider always the relationship of the jaws from the standpoint of a unit, and never undertake individual movements of the teeth of one jaw or changes in the relationship of the jaws without due consideration for compensatory and complementary movement in the opposing jaw.

The fourth general principle is that all orthodontic work is performed on living subjects, and as such is influenced by all the functional co-operation and assistance of which the patient is capable, particularly in regard to the control and direction of muscular effort. At all times the minimum of actual mechanical interference should be employed.

Like a good general, an orthodontist should plan his campaign at the start. As many of the factors he will have to deal with are unknown quantities, and can only be determined during the course of treatment, he should have his mind free at all times to observe the reactions of the tissues, the degree of co-operation he is getting from his patient, and every other factor concerned with the case and be ready at any moment not only to change his method of treatment, but even his final objective. A course of treatment resolves itself naturally into phases in which at one time a certain objective is desirable in its relation to the whole, and after this has been attained the next step or phase may follow in which the nature of the problem may be different, requiring a different type of appliance for its accomplishment.

An efficiency expert made this significant remark: "Whatever your problem may be, think of it in terms of the greatest possible simplicity, then break it up into steps and treat each step separately."

This is good advice for all kinds of problems, but when it comes to problems concerned with the functional activities of living organisms, this method of procedure is not only a good one, but also the only one, which it is possible to pursue at all. There is no choice in the matter.

There is nothing more stupid going on in Orthodontics today than the silly preferences and prejudices in regard to appliances. On general principles I think it can be safely said that the simpler the appliance, and the more perfect its adaptability to the correlation of the movements of the jaws and the opposing teeth, the better the treatment. There are some appliances which by their sheer intricacy in the effort to do too many things at the same time, defeat their own purpose.

There are, naturally, many factors to be considered in the treatment of every case, and each factor must be evaluated in its correct importance to a comprehensive whole. It is tiresome to discuss these abstractly.

The case reports which are here presented involve some of the factors and basic problems encountered in everyday practice. The one thing absolutely certain, however, is that the same combinations of factors here shown will never be found again regardless of how similar cases may appear at first glance. There is no duplication in nature.

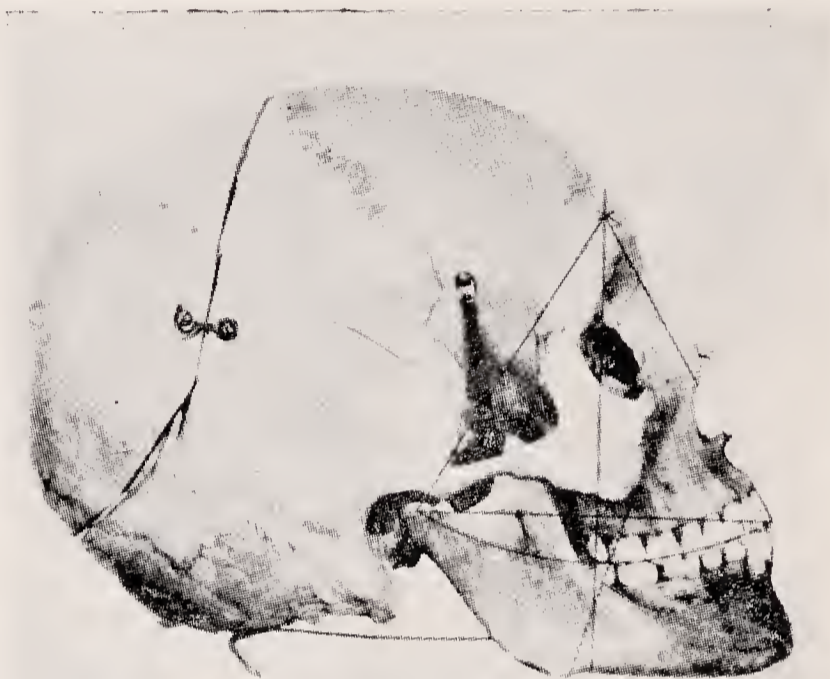


Fig. 1

Fig. No. 1 represents *Ideal Occlusion*, a combination of structural balance, functional efficiency and æsthetic harmony with a full complement of 32 well-proportioned teeth.

There is no reason, scientific or otherwise, why it should be set up as the goal of treatment. It can be demonstrated on the simplest and soundest basis of logic and common sense, and with a minimum of artistic perception, that an ideal, or so-called 'normal' occlusion is for some individuals the most undesirable arrangement that could be desired for them, and in many cases completely impossible to attain. The number, relation and orientation of the teeth are only details of a much more comprehensive whole.

Fig. No. 2 illustrates in a humorous manner, perhaps the most important single factor concerned with orthodontics, and the main cause of mal-occlusions of the teeth. The profound significance of the human race cannot be over-estimated in its relation to the positions and sizes of the teeth. The peculiar form of the Dachshund constitutes its own peculiar 'genetic pattern' or 'individual normal.' Orthodontics consists mainly in altering 'individual genetic patterns' which are unsatisfactory.

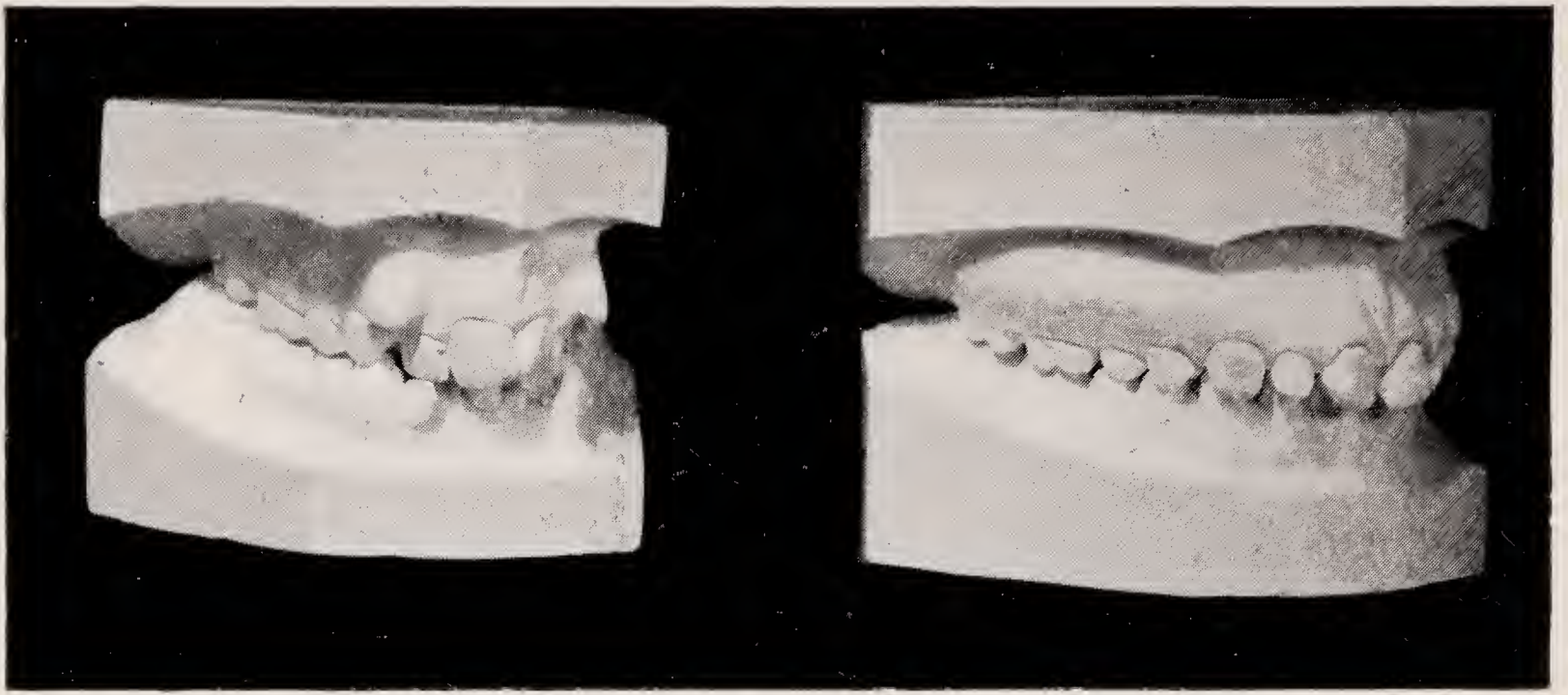
Fig. No. 3 illustrates two extremes of 'natural' variation.

The two individuals from whom these casts were made are two "typical" American youths of high-school age. Physically they could easily be taken for brother and sister. Does it seem logical that the enormous discrepancies in the proportions of the teeth



Fig. 2.

A humorous cartoon taken from a cover of "The New Yorker" illustrating in graphic form perhaps the most important single factor concerned with Orthodontics. The hybridisation of the human race cannot be over estimated in its influence on the sizes and relations of the teeth and bones.



A

Fig. 3

B

Extremes of "Structural Imbalance" in "Natural" occlusions



Fig. 4



Fig. 5

and the growth and development of the jaws can be attributed to differences in environment and nutrition? If stimulation is what is needed in the one case to increase the proportion of bone, what about the other case in which there is too much bone for the size of the teeth?

This brings up the delicate and controversial subject of 'extraction' which has recently been debated at length 'pro' and 'con.' The results of the treatment of these two cases is shown in Figs. (A) 4 and 5, (B) 6 and 7. Can anyone with an atom of common sense or artistic feeling think that the case A could have been improved without some judicious extraction? As can be noted, four premolars were removed to obtain the result which is shown. The amount of tooth movement possible is determined to a great extent by the apical bases of the teeth and the amount of basal bone present. A comparison of these two cases, A and B, is a study in itself of one of the basic problems in Orthodontics. Between these two extremes there lies a stretch of hallowed ground where only angels dare to tread! Nature very kindly leaves us a reasonable margin for error. It is inane to think that extractions are not justifiable, but they should be considered with perhaps greater conservatism than is being practised by some groups at present.

As every case treatment proceeds to its final objectives in a series of correlated steps, it is very seldom, if ever, indicated that the same appliance should be used for the entire treatment of a case, any more than it is sensible to use the same club for an entire round of golf. The choice of appliances depends, therefore, on the orthodontist's basic philosophy of the subject. At the present time there seems to be a division of ideologies in Orthodontics as definite and incompatible as those between communism and democracy.

Being by nature a democrat and an unqualified individualist, I personally look for appliances which permit of the utmost originality and latitude of adaptability with the ever present and inescapable factor of infinite variation. That comes before any other consideration.

If I were given the choice of only one appliance, I would unhesitatingly choose the plain labial arch with the infinite variety of labial auxiliary springs adaptable with its use. Figs. No. 8 and 9. It would be idiotic, however, not also to use other appliances.

Bite planes and working retainers are indispensable if we are to avail ourselves of the unlimited power and natural force of muscular function. Fig. No. 10. Not to use this force is like setting up a steam plant on the banks of Niagara.

Lingual arches with auxiliary springs are the most logical appliances to use for certain tooth movements. In the form of cribs or guide planes they have their definite place. Fig. No. 11.

The Johnson twin-wire appliance is par-excellence the ideal appliance to use where the compensatory action of its gentle force is needed for the movement of numerous incisors simultaneously. In skillful hands it has a much greater latitude of usefulness. Fig. No. 12.

Figs. No. 8 and 9 illustrate the plain labial arch with a variety of labial spring attachments.

These appliances, used sometimes in conjunction with bite planes or lingual cribs are, in my hands, the most logical and useful in



Fig. 6

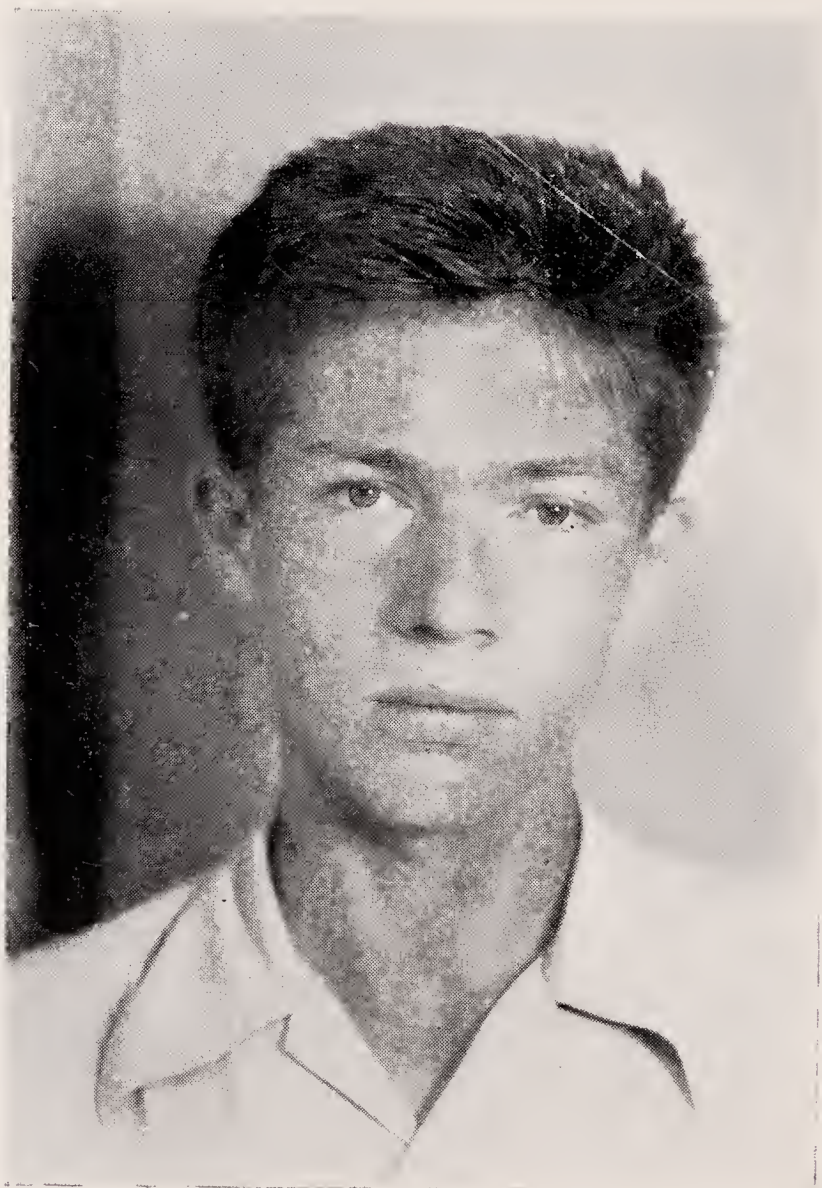


Fig. 7



Fig. 8

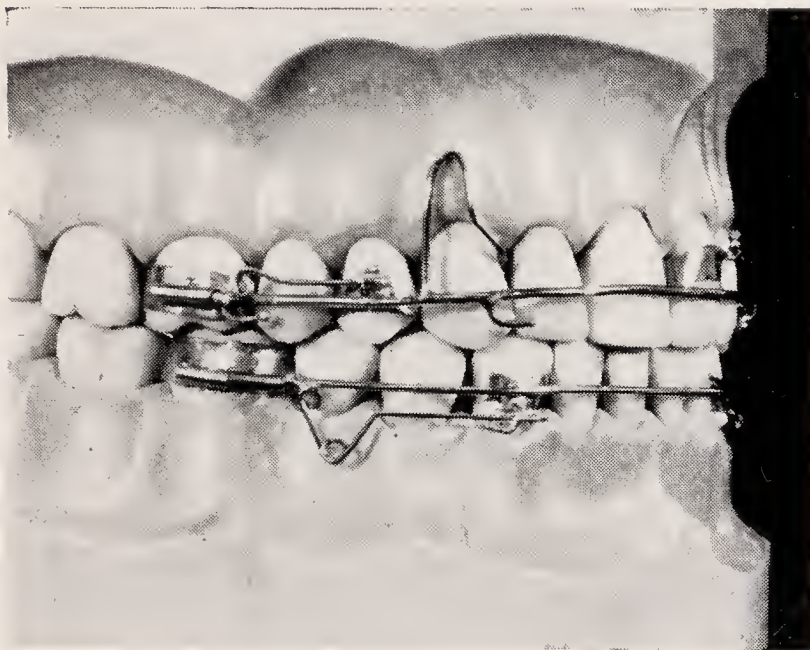


Fig. 9



Fig. 10. Bite-plane retainer

effecting simultaneous body movements of the mandible in conjunction with distal movements of the maxillary molars and premolars together with individual incisor movements.

The mandibular labial arch with auxiliary springs placed within bracket hooks on the mandibular canines and ligated to the incisors affords an anchorage for intermaxillary traction incomparably superior to the plain lingual arch. As the coronal positions of the mandibular teeth are controlled by the shape of the labial arch, judicious pressure from auxiliary springs, applied gingivally to the labial arch, may produce torque, rotations or depressions of these teeth in a gentle continuous manner without the danger of the ill-effects where harsher methods are employed. Sometimes the mere supra-occlusion of one or both mandibular canines is the sole interference that prevents a perfect occlusion. Depressing them gently permits also of just enough labial expansion for the proper alignment of the other incisors.

The pivotal point for decision in treatment starts always in my own mind with a consideration of that somewhat elusive but nevertheless vital picture known as the position of "Occlusal Advantage."

Figs. No. 13, 14, 15 and 16 are photographs of the 'natural' occlusions (right and left sides) and the occlusion in the position of "Occlusal Advantage," of the boy shown in Figs. 17 and 18.

In looking at this case from the position of "Occlusal Advantage," it is obvious that some desirable changes are needed in the mesio-distal relations of the mandible and that in order to accomplish this movement some changes in the vertical relations of the teeth are indicated. An appliance which will effect a downward and distal drive of the molars and premolars simultaneously with a forward and intrusive effect on the incisors would seem the logical appliance to employ.

This case was treated with labial arches and auxiliary springs of the type illustrated in Figs. No. 8 and 9, together with a series of removable bite planes. It is remarkable how little intermaxillary elastic force is necessary when by means of bite-planes and the intelligent co-operation of the patient, the mandible assumes an entirely new relation to the maxilla, with a complete change in the vertical relation of the teeth. Within a very few months it was impossible for this patient to bite distally to the position shown in Figs. No. 17 and 18.

Fig. 19 shows the models of the right side of a case of disto-occlusion and cross-bite, combined with a fair degree of structural balance between the size of the teeth and the bony development, but great facial disharmony owing to an extremely small mandible, displaced distally.

Fig. No. 20 is a view of the same models from the left side. Note the position of the left lateral maxillary incisors. Figs. No. 21 and 22 are views of the models placed in the position which they assume when the patient bites in the position of "Occlusal Advantage."

Fig. No. 23 shows the patient biting in the position of "Occlusal Advantage." In this position the only teeth that occlude are the lower incisors and the left lateral maxillary incisor.

The first step in treatment consisted in placing a plain labial expansion arch on the first maxillary molars, a labial auxiliary spring on the maxillary left lateral to move it slightly labially, and

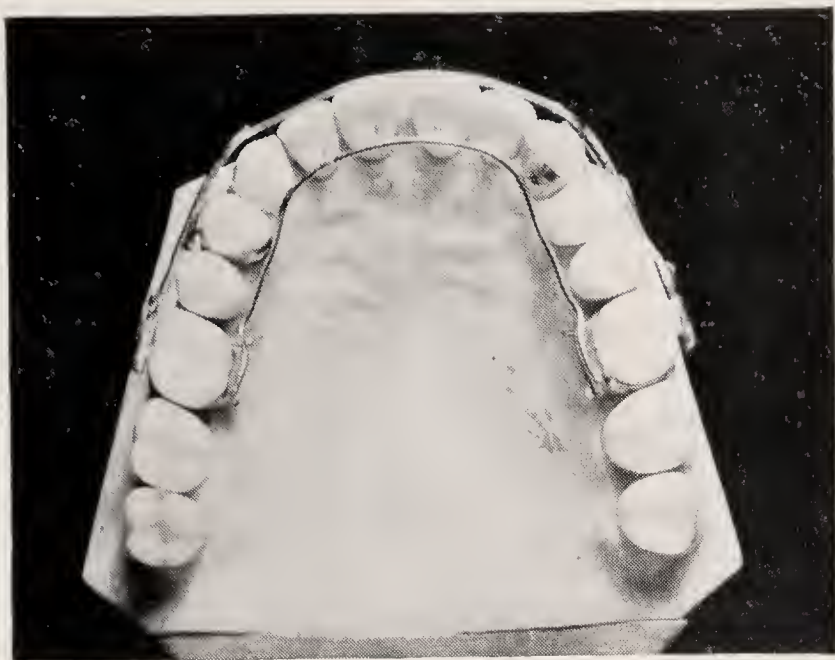


Fig. 11. *Lingual Crib or Guide Plane*

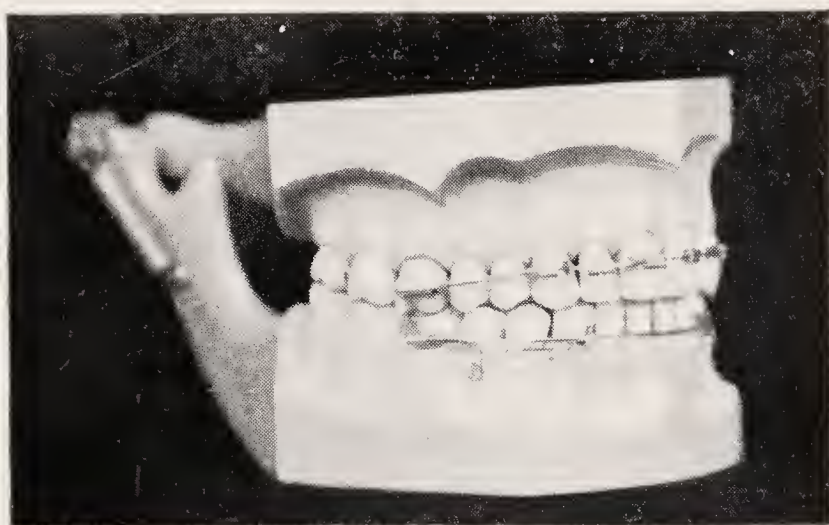


Fig. 12. *"Johnson" Twin-wire appliance*

a short bucco-lingual elastic from a hook on the lingual surface of the *upper* right first molar to a hook on the buccal surface of the *lower* right first molar. In the course of a few weeks the bucco-lingual relation of the upper and lower first molars had been corrected and the patient was able to place the mandible in a much more satisfactory mesial position in relation to the maxilla owing to the removal of the interference of the left lateral incisor. At this point a Johnson twin wire was inserted temporarily to align the maxillary incisors, continuing the bucco-lingual elastics on the molars. When this was accomplished, the twin-wire was removed and a lingual crib was inserted, together with a plain labial arch with intermaxillary hooks. The labial arch was wired to hooks placed on bands on the first premolars, as illustrated. A labial arch with auxiliary springs on the canines and ligatures on the incisors was constructed for the mandibular teeth and intermaxillary traction started. The less that intermaxillary traction is used and the more the patient can aid in repositioning the mandible by voluntary muscular effort, the more natural and the better the treatment. The appliances employed were designed for that purpose, and to so change the vertical relations of the teeth that the forward position of the mandible would be, in the shortest space of time, the most comfortable and natural one to maintain.



Fig. 13. "Natural Occlusion"



Fig. 16. Position of "Natural Occlusion"

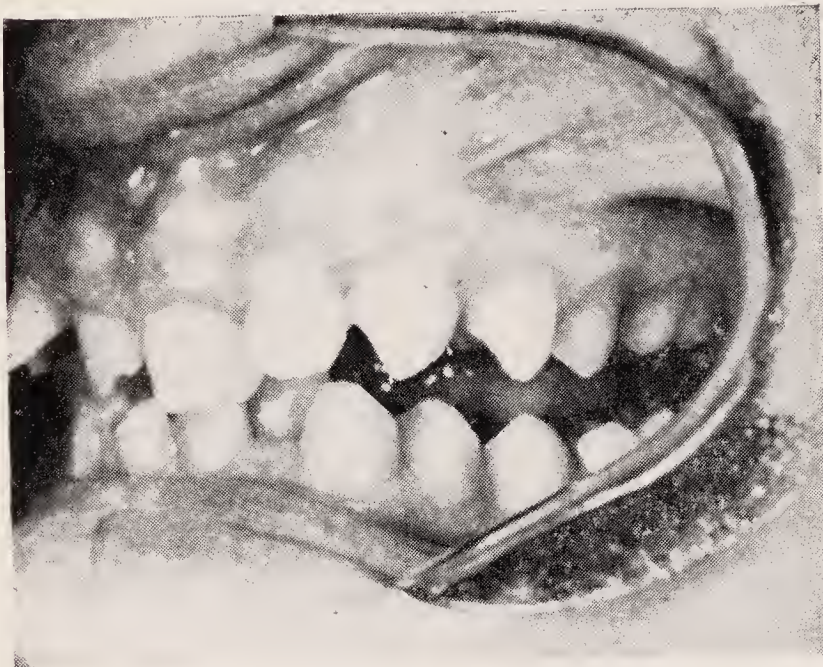


Fig. 14. Position of "Occlusal Advantage"



Fig. 15. Position of "Occlusal Advantage"

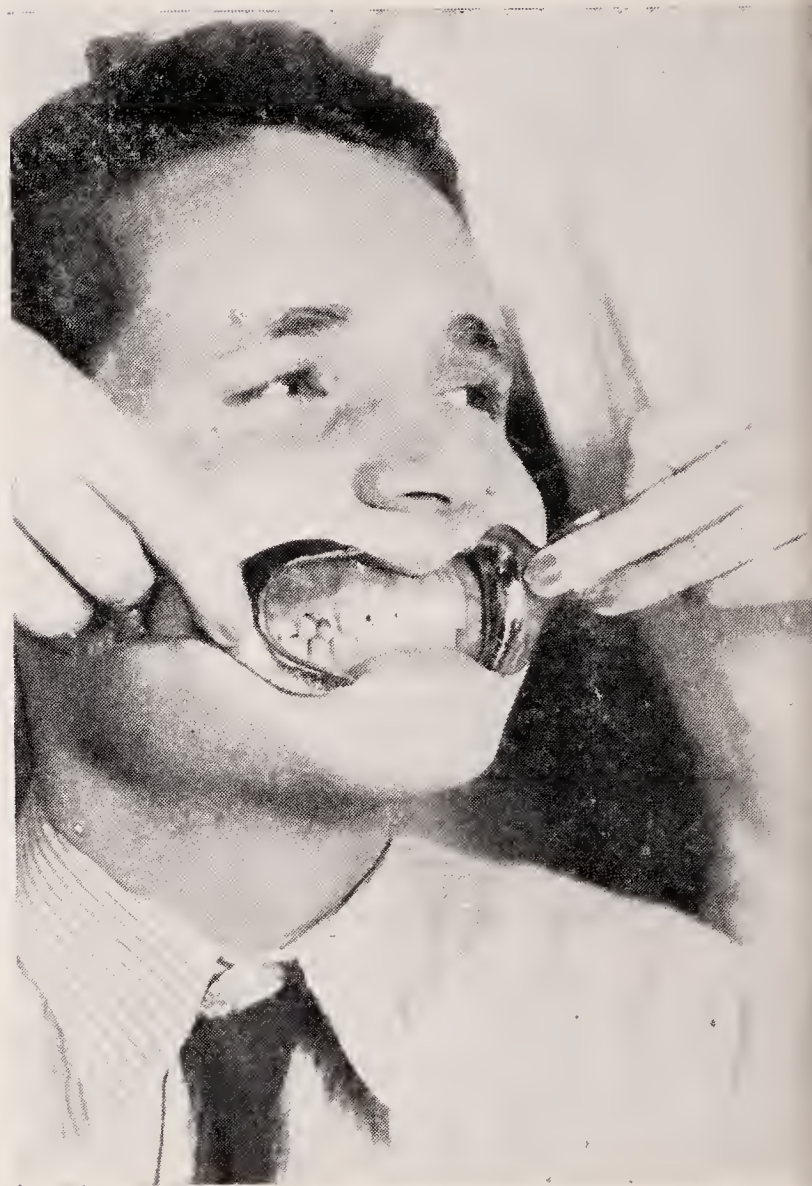


Fig. 17. Improvement in "Functiona Efficiency" from Figs. 13 to 16



Fig. 18

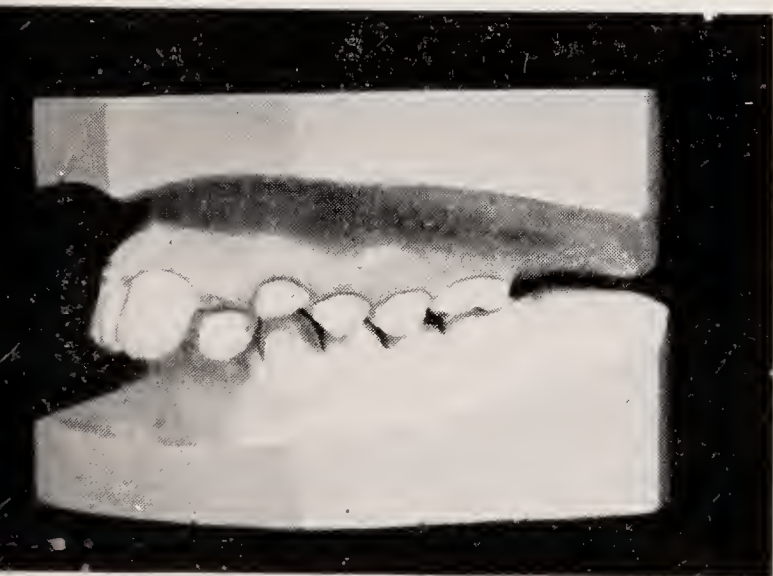


Fig. 19

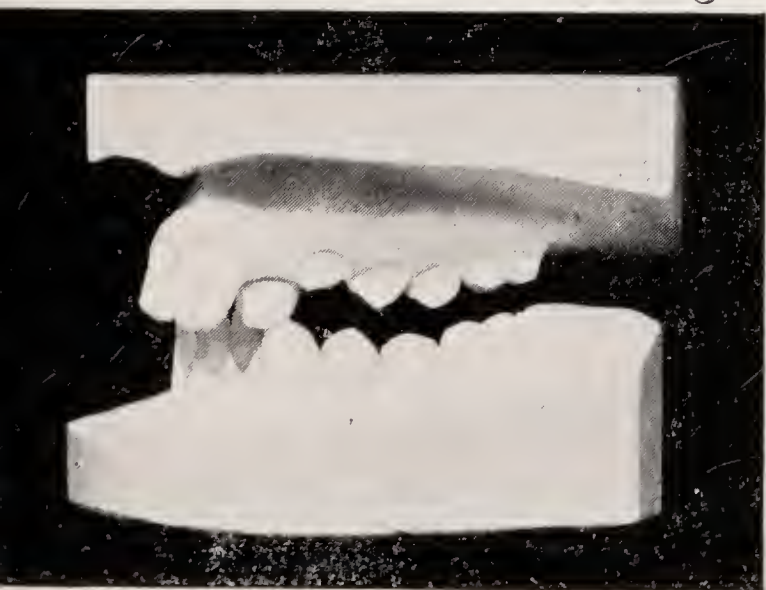


Fig. 20



Fig. 21



Fig. 22

Fig. 18. Facial balance of patient shown in Fig. 17.

Fig. 19. Models of "natural occlusion" of patient shown in Fig. 23 (left side).

Fig. 20. Models placed in position of "occlusal advantage" of patient shown in Fig. 23 (left side).

Fig. 21. Models of "natural occlusion" of patient shown in Fig. 23 (right side).

Fig. 22. Models placed in position of "occlusal advantage" of patient shown in Fig. 23 (right side). This can only be determined by a study of the patient.

Treatment of this case was started in June, 1946, and Fig. No. 24 shows the position of the jaws in January, 1947. Fig. No. 25 shows the appliances just described in place, Fig. No. 26 the occlusion with the appliances removed.

Figs. No. 26 and 27 show a case of quite extreme maxillary constriction, together with a more than well developed mandible. Fig. No. 28 shows the occlusion as a result of conservative treatment. Fig. No. 29 is a photograph of the patient. I think she will get by.

Figs. No. 30, 31 and 32, show a case of a very constricted maxilla with a well-developed and well-proportioned mandible in its relation to facial balance. The bite was in disto-occlusion. The removal of two maxillary first premolars and the alignment of the teeth with a Johnson twin-wire produced the results shown in Fig. No. 30. It is tragic to think that many of us started our orthodontic efforts with a goal of a full complement of teeth in every case, and that the basis of diagnosis was the relations of the first molars, regardless of other factors, many of which are far more important than these. Time marches on !

There are some cases in which the use of Johnson twin-wire is so ideally suited to requirements that to report the results of treatment is merely to pay tribute to the contributions which Dr. Johnson has made to Orthodontics. Figs. No. 33 and 34 show a condition in which the reciprocal force of the twin-wire arch on several teeth makes treatment simple and effective. Fig. No. 35 shows the appliance which did the trick, and Figs. No. 36 and 37 the case after treatment.

Orthodontics might even be more fun than it is if it were not for some of the limitations beyond our control. Fig. No. 38 (another pituitary case).

Fig. No. 39 shows the final result of active treatment of a case which has undergone several years of orthodontic treatment before coming to me. The patient himself was a veritable giant in size, about six feet eight inches, with a somewhat acromegolic appearance. The condition as I took it over was in mesio-occlusion and open-bite ; a delightful combination ! During the previous treatment two maxillary premolars had been removed. To compensate for this I had the two first mandibular premolars extracted, and after a hard struggle obtained the occlusion shown, which is fairly satisfactory from the standpoint of function and appearance. From there on the question of retention became the problem. In order not to keep the appliances on for the rest of the patient's life I devised the retainer which is shown in Fig. No. 39. This consists of an ordinary Hawley retainer to which is soldered a labial extension which presses against the lower incisors when the mouth is closed. In addition to exerting pressure against the teeth, it acts mainly as a reminder to the patient to keep his mouth closed, and the mandible as far back as possible. The patient is exceedingly co-operative, and it seems to be the solution to a difficult problem of retention.

Orthodontics is claimed by some to be mainly a growth problem, though why nature should take such peculiar forms at times is difficult to understand. The unusual size of the mandible seems, in some cases, to be due to some endocrine disturbance. Whether this be the cause or not, there are cases beyond the limit of Orthodontic therapy alone. Such a case is shown in Figs. No. 40 and 41.



Fig. 23. Patient biting in position of "occlusal advantage."



Fig. 24. Change in occlusal of patient shown in Fig. 23.

The only teeth in contact were the second molars. Outside of the occlusion of the teeth the individual seemed quite normal physically. A combination of some oral surgery (by Dr. James Cameron) and some orthodontics produced the result shown in Figs. 41 and 43. The oral surgery consisted of a double re-section of the ramus of the mandible. Preparatory to this the Orthodontic work consisted in banding every tooth in both jaws and adjusting labial arches of .038 inch wire on brackets on each tooth. To these arches were soldered spurs at carefully selected intervals, so that immediately after the operation, short intermaxillary elastics were stretched between the spurs of the opposing jaws to keep them in the most desirable position until the consolidation of the bone had taken place. To finish case of this kind satisfactorily some further orthodontic treatment is usually necessary. A fastidious Orthodontist is usually much harder to please in the final result than the oral surgeon who sends him the case!

The range of Orthodontics is only limited by the creative imagination, deductive logic and intuitive insight of those who have the temerity to engage in this form of artistic dental effort.

DISCUSSION

Mr. Russell Marsh said it was difficult to express his happiness at having his friend, Frank Jackson, in this country again. It was like old times, with the difference that they all of them, on both sides of the Atlantic, knew a little more than they did when he was here before. Dr. Jackson was the first American colleague in the last ten years to visit this country—a kind of second Columbus, in reverse. Columbus discovered a land of plenty, and that was the reverse again. He wished to say to him that they all honoured a great orthodontist, for an orthodontist was something of a scientist, an artist, a practical thinker, and a great technician. They knew Dr. Jackson to be all these things, and they welcomed him with the esteem and affection that his own generosity and his sincerity had evoked. By generosity he meant not only his astonishing hospitality to them when they went over to America, but also his willingness to share his knowledge, his ideas, his appliances and instruments, with any colleague. He had always treated them in this country with respect and with sympathy in their difficulties, and his transparent honesty was one of his greatest qualities. In fact, he could say that Frank Jackson was nothing if not frank.

Dr. Jackson would tell them that he started his career with one particular misconception—that was, the Angle conception that we were given 32 teeth and that not one of them was to be extracted. He was never actually an Angle man, but nevertheless he extracted teeth rarely and always with misgiving. He had come gradually by a hard way to believe that in certain cases extractions were inevitable. The speaker personally was satisfied that today if Dr. Jackson treated a case with extraction there was not a man living who could produce a good result without. About two years ago in a paper the present speaker discussed sympathetically the attitude of the Angle men towards this question of extraction. He said that they feared that if they gave way an inch in their ideas there would

(continued on page 124)



Fig. 25



Fig. 26



Fig. 27



Fig. 28

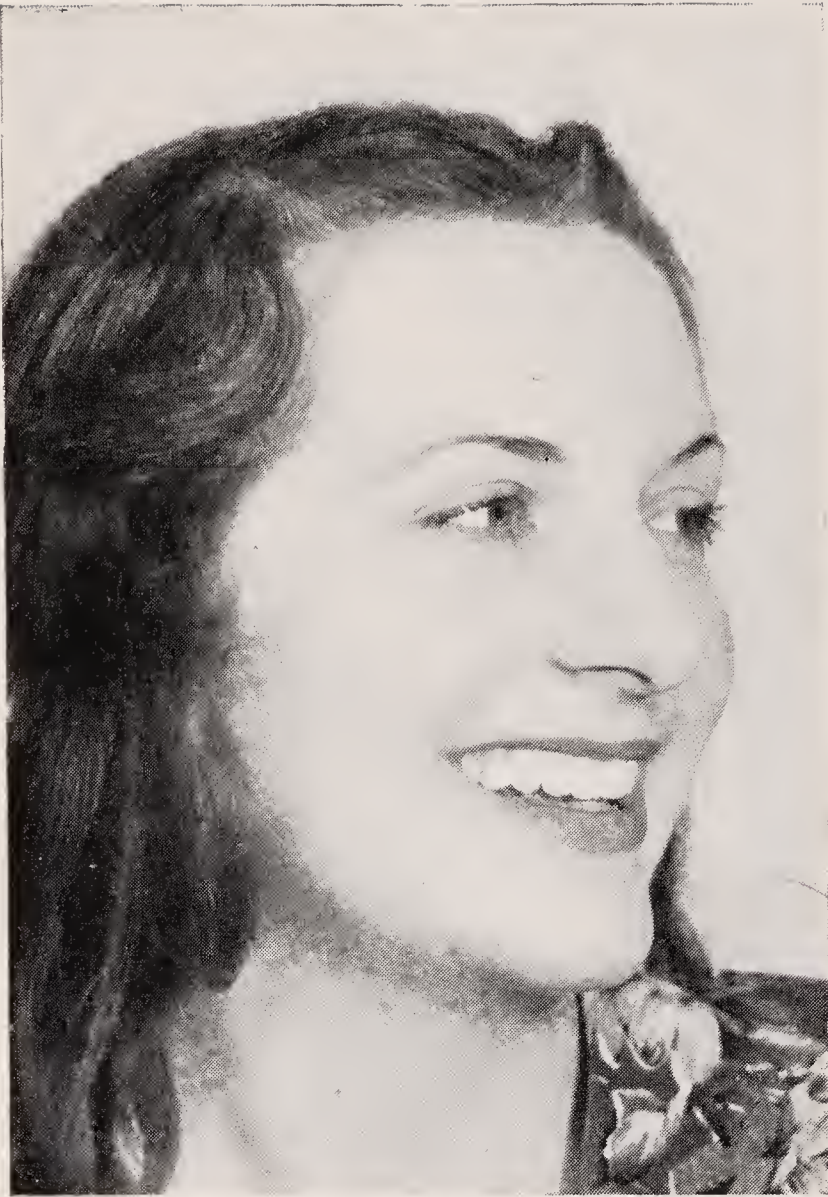


Fig. 29



Fig. 31



Fig. 30



Fig. 32

Fig. 25. Labial appliance used in treating case shown in Fig. 23.
 Fig. 26. Facial balance before treatment of case shown in Figs. 27-29.

Fig. 27. Occlusion before treatment. Very constricted maxilla; well-developed mandible; good facial balance.

Fig. 28. Result of conservative treatment of occlusion shown in Fig. 27.

Fig. 29. Occlusion and facial balance at end of treatment of case in Figs. 26-28.

Fig. 30. "Natural" occlusion before treatment of case shown in Figs. 31-32.

Fig. 31. Occlusion after treatment with removal of two maxillary premolars.

Fig. 32. Facial balance after treatment.



Fig. 33. Occlusion before treatment of case shown in Figs. 34-37.

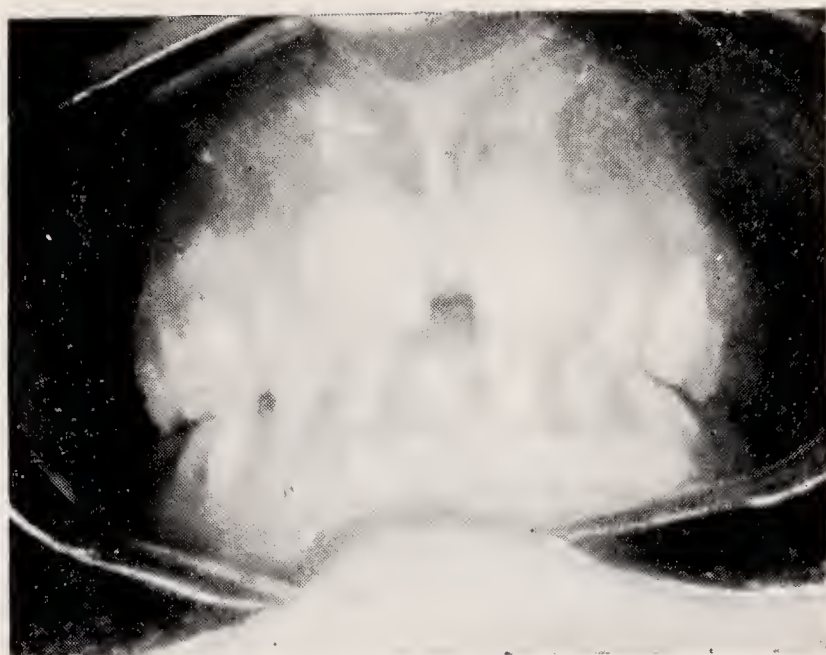


Fig. 34. Occlusion before treatment of case shown in Figs. 33-37. Frenum was not excised.



Fig. 35. Johnson Twin-wire appliance used in treating case.

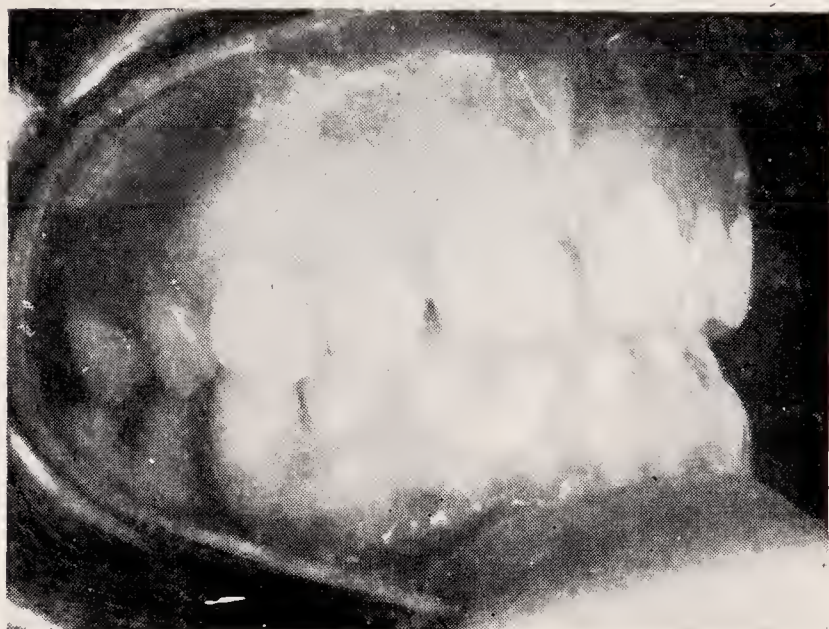


Fig. 36. Result treatment using Johnson Twin-wire appliance.



Fig. 37. Occlusion at end of treatment of case shown in Figs. 33-36.

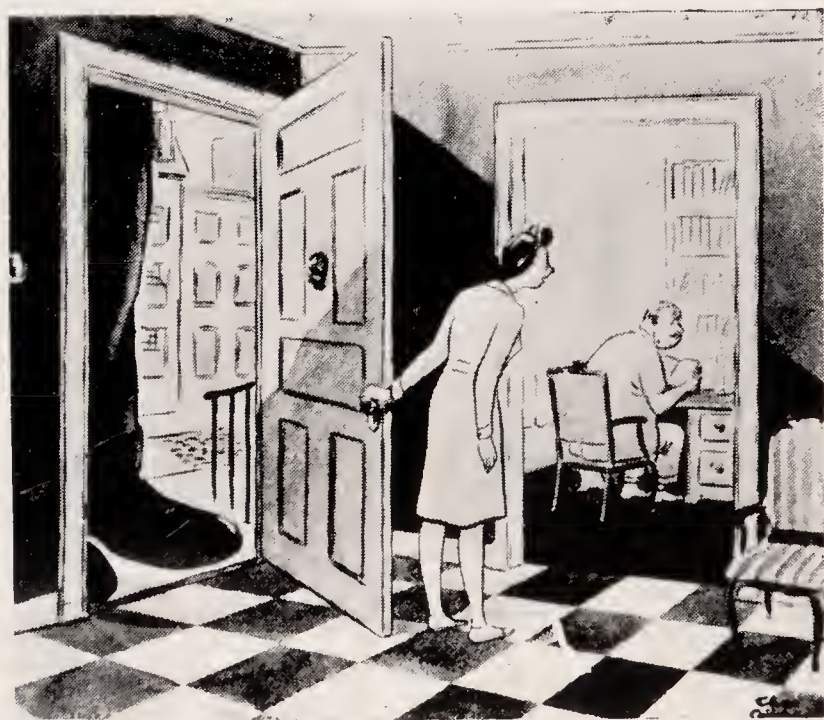


Fig. 38. "It's another of those pituitary cases, Doctor." (Collier's)

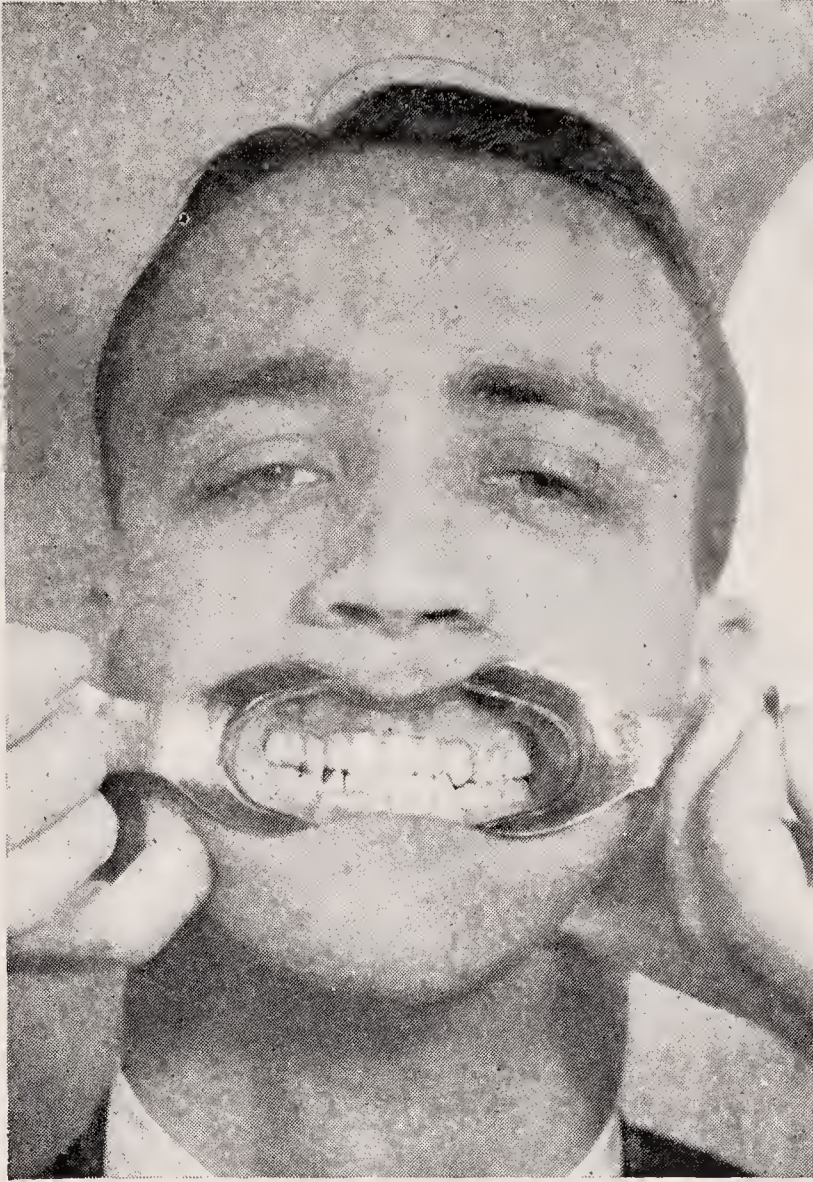


Fig. 39. Retaining appliance used after treating case of mesio-occlusion including over-development of the mandible.



Fig. 40. Facial appearance of case shown in Figs. 40-45. Treated by double re-section of the ascending rami of the mandible and orthodontic therapy.



Fig. 41



Fig. 42



Fig. 41. Occlusion before treatment of patient shown in Fig. 40. The only teeth in contact were the four second molars.

○

Fig. 42. Occlusion after treatment with orthodontic appliance in place.

○

Fig. 43. Facial improvement after treatment.

○

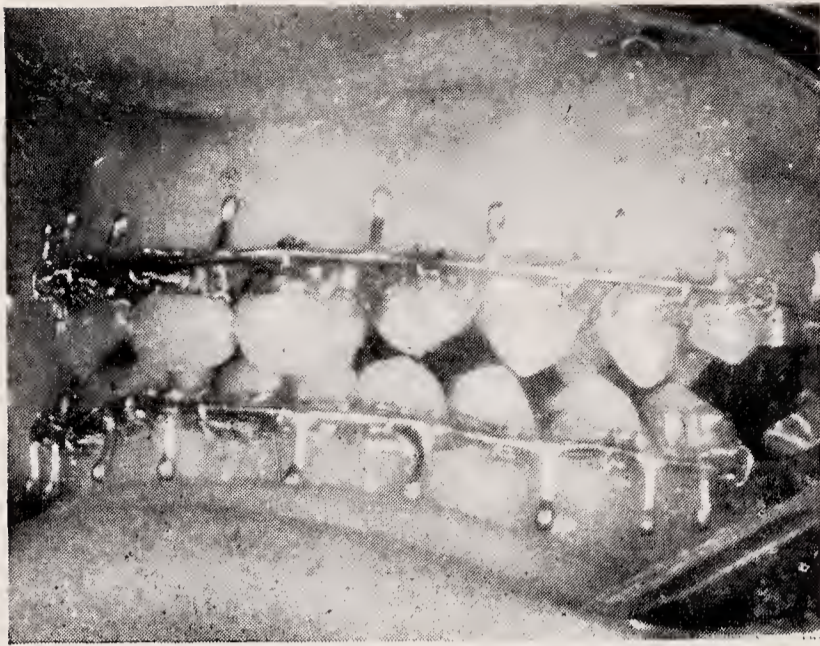


Fig. 44.

Orthodontic appliance used to reposition and stabilise the jaws after operation of double re-section of the mandible.

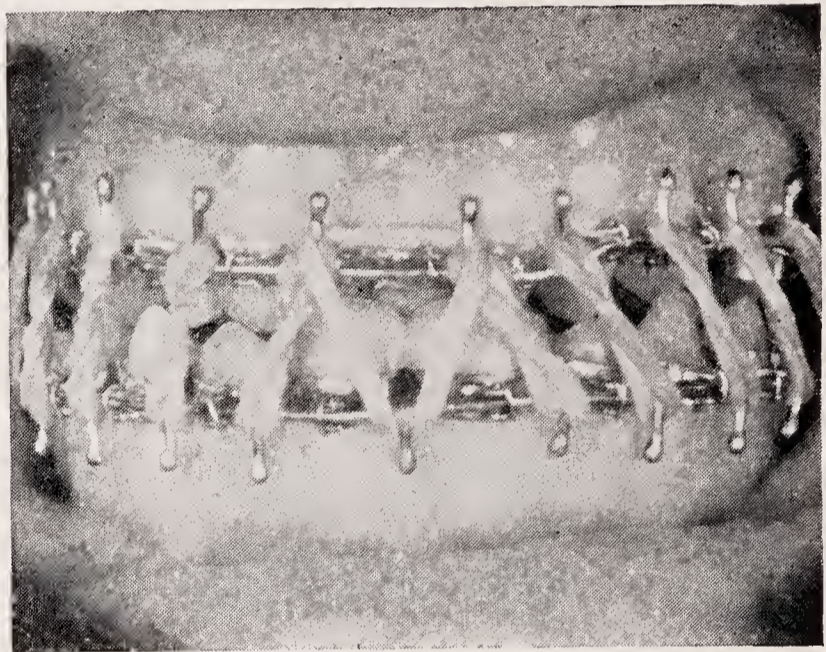


Fig. 45.

Short inter-maxillary elastics used to maintain a desirable occlusion after operation of double re-section of the mandible.

(continued from page 118)

be a rapid landslide in the opposite direction. That had already been actually demonstrated. But that swing of the pendulum would settle down in time. A great gulf, wider than the Atlantic, had divided them in the past. While one half of the orthodontic world continued to support Angel's theory, the other half took the opposite view, so perhaps it was a good thing that there had been some change of policy in this respect. At the present time they were either all of them right or all wrong, but at least they could work together and he was sure they could help one another a great deal.

They had listened that evening to a wonderful lecture, and they could all go away with one or two of their difficulties solved. Dr. Jackson had helped to clarify their thoughts and had given them a bird's-eye view of their job. It was interesting to notice to what extent

these ideas ran parallel in different parts of the world. On the one side there were Jackson and Rogers working on their bit of occlusal advantage, and on this side there were the Norwegian workers determined also to get an occlusal advantage although they had not given it that name.

He wished to tell the audience that all the beautiful appliances they had seen on the screen were hand-made by Dr. Jackson himself. If they saw him working in his surgery, as he himself had done, they would be astonished at the rapidity and skill with which that work was performed.

Dr. Henry Oscar said that the Society was most fortunate in having Dr. Jackson come to them that evening to tell them about his work. Dr. Jackson spoke from nearly thirty years' experience. He was a man who had been through the evolution of orthodontics in America, and he was well able to give them the best of everything to-day as it was understood on the other side of the Atlantic. He testified to his great friendship with Dr. Jackson for more than twenty years. In their friendship they were able to sink their little differences over the question "Thou shalt not extract."

Mr. Johnson said that Dr. Jackson had brought forward a most valuable lot of observations on the methods prevalent in American literature to-day. It seemed from that literature that in America they were accustomed to band all the teeth while here it was usual to band very few. He was interested in his remarks about the open bite. He did not realise that the effect of inter-maxillary traction in bringing the mandible forward might bring about an open bite in such cases as Dr. Jackson had mentioned. Another thing which had occurred to him arising out of Dr. Jackson's lecture was on the question of anchorage. He remembered Prof. Oppenheim some years ago suggesting a technique of lingual arch in the upper and labial hooks which were attached to the chin; this was not exactly anchorage, but that contrivance on the chin was stabilised by extensions to a head cap. He had tried that in many cases but was not quite convinced of its success. More recently there was an arrangement for the use of acrylic resin appliances holding the maxillary teeth and extending slightly labially. It would be interesting to have Dr. Jackson's observations upon that.

Mr. Maxwell Stephens joined in the thanks to Dr. Jackson and said they had had a most fascinating lecture.

Miss K. C. Smyth, in also thanking Dr. Jackson for his lecture, said that on the question of æsthetic balance it struck her when listening to him that it was really a question of balance that did characterise his own outlook on orthodontics. There was no need, as they had rather tended to do, to divide orthodontists into extractionists and non-extractionists. It was a question of balance between the two. There were cases in which extraction was right and others in which it was wrong, and it was the ability to distinguish properly between these two classes of cases which made the good orthodontist.

On the term "occlusal advantage", the idea expressed by that was of the very highest importance, and she thought many people in this country had been using the idea more or less, although perhaps not so universally and in so highly specialised a way as Dr. Jackson had shown them. But the term itself was misleading and it would be more helpful especially in teaching students and

young orthodontists if they could think of a term more truly descriptive of what was designated—some such term as “the optimum relationship of the jaws.”

Mr. Rowlett said how much he had enjoyed Dr. Jackson's demonstration. He had had the pleasure of seeing his work in his own office, also some of the cases he had illustrated, and he had always drawn great inspiration from his work. There were many moot points in orthodontics, but Dr. Jackson had made an unusual contribution to that harmonious activity which they were all looking for between their respective nations. He himself was going in a short time to America to promote the International Dental Federation. During the war he was in America three times and on each occasion he enjoyed Dr. Jackson's hospitality. He knew what Dr. Jackson had done to promote good relationship not only between British and American orthodontists but between the citizens of Gt. Britain and the United States generally.

Mr. Norman Gray joined in the tributes to Dr. Jackson. He said that he first met him when he was himself a student in Philadelphia. He was particularly struck by his insistence upon pictorial records of his cases, and he thought that if all of them undertook a little more photography in their work they might find it a help. In the case of upper molars and lingual occlusion of the lower, Dr. Jackson used elastics, but he himself in one case at the moment, following Dr. Jackson's method, had found the part get very tender. The question of occlusal advantage was a very big one and represented in his view a tremendous step forward.

Mr. Endicott took the opportunity of adding his word of thanks to Dr. Jackson. Whenever he saw anything written by him he read it very carefully, and he had followed everything of his for a number of years. It always struck him that he was probably the most practical man in the orthodontic field to-day in any country. They had missed a great deal that evening by not seeing Dr. Jackson's pictures projected on a larger scale. He thought particularly of some pictures of his which were published in the *American Journal of Orthodontics* about 1943 and had the merit of being not only very humorous but very instructive.

Dr. Jackson, in reply, said that he scarcely knew how to answer the very flattering remarks by Mr. Marsh and others. He could only say that he appreciated them from the bottom of his heart. It was true, as Mr. Marsh had said, that he had come here with a feeling of sincerity, keen to promote Anglo-American relations, that was certainly true. He had a feeling not only of friendship but of affection for everything British and this went very deep. He was of British extraction himself—his father a Scotsman and his mother of English descent. He also wanted to make a remark about Dr. Rowlett's reference. He did not know of any ambassador of goodwill who was better prepared to do the job which he had been doing than Dr. Rowlett. His visits on the other side had been models of the way in which a man should conduct himself in order to show the best side of the British character.

With regard to some of the specific points, he had mentioned in his lecture several times the question of open bite, because he knew of nothing which was more undesirable in orthodontics than open bite. It had been a matter of common knowledge that practically all cases of open bite were associated with some deeper

deformity. He had seen cases which had been treated and which although they were not open bite to begin with had developed open bite in the course of treatment. They were dealing with something which had infinite variation, and they did not know what was going to happen. He could recall cases where on first looking at the models the case appeared to be one of closed bite, and yet between the first visit and the second visit there were signs of that bite opening immediately he took off the appliances which he had put on.

The control of the tongue was another of the major matters in which he was interested just at present, and Dr. Henry had been very kind and had promised to give him some material on that subject. He had not used acceptable anchorage except in one or two cases, and then with not very good results. In the States recently, at one of the meetings of the New York Society, Dr. Fisher presented an extremely good paper in which the results were really quite startling. They were cases of distal occlusion in which he had used nothing but acceptable anchorage to bring the upper molars back, and he was surprised to find that although he had put nothing on the mandibular the position of the mandible was further forward than when he started, which, in his view, corroborated the fact that once the interference was removed the mandible would almost go forward by itself. He had shown him the appliances he had used for this anchorage in children. How he got them to use it he did not know, but apparently he did.

In reply to Miss Smyth, the most valuable single idea in the last few years in orthodontic practice had been this idea of Rogers. He had called it the position of mechanical advantage—that was the term he used. He himself began thinking about this matter and presently he thought to himself—"occlusal advantage". This was not entirely satisfactory and he had substituted the term "occlusal preference."

Miss Smyth: That is something you are aiming at?

Dr. Jackson said that that was so. He called it occlusal advantage instead of mechanical advantage because they were dealing, after all, with teeth. But perhaps some term which was better still could be invented.

With regard to the cross-bite elastics mentioned by Mr. Norman Gray, these had to be used, like everything else, with a certain amount of caution. He had come across cases where the child was biting with the teeth on one side in complete occlusion, so that a tremendous traction was being used. While the elastic was over the tooth surface the children were apt to consider it a kind of "indoor sport" and tried to see how soon they could bite one through. But he had not had any very serious trouble.

He thanked Dr. Endicott for his kind remarks and he was sorry that his pictures did not show up to better advantage. They were intended to illustrate a graphic way of presenting the most important facts in orthodontics, in particular the genetic pattern over which the individual had no control. He was accustomed to show these pictures to the parents and explain what they were about. He would tell the parents that although they thought their child was abnormal, in fact he was not abnormal at all, he was what he was as the result of heredity and environment. It was very amusing to hear the two parents starting sometimes to accuse one another, one of them reminding the other that he or she had an uncle who

was something like that. Many times he had kept these cases under observation for years before he made up his mind what was best to be done.

In conclusion he thanked them again for their exceedingly kind reception of him. He tried honestly and sincerely to follow the middle road. He tried to take from every man what he thought was best and to correlate it with a large picture. They were dealing, he reminded them again, with an infinite variation.

The Chairman, on behalf of the members present, expressed sincere thanks to Dr. Jackson for coming and delivering so excellent an address. Prior to that meeting they had had a meeting to decide that the subscription to the Society should be increased, and he thought they might call on Dr. Jackson next year to give them a further talk in order to show members that their increased subscription was well worth while.

Dr. Jackson said that in 1949 there was to be a great meeting of orthodontists in New York. In due course invitations would be extended to the British Society, and he hoped that as many members as possible would come over to that meeting. While it would not be called international it would have a strong international flavour.



IDENTICAL TWINS

with

Upper Incisors Locked Lingually

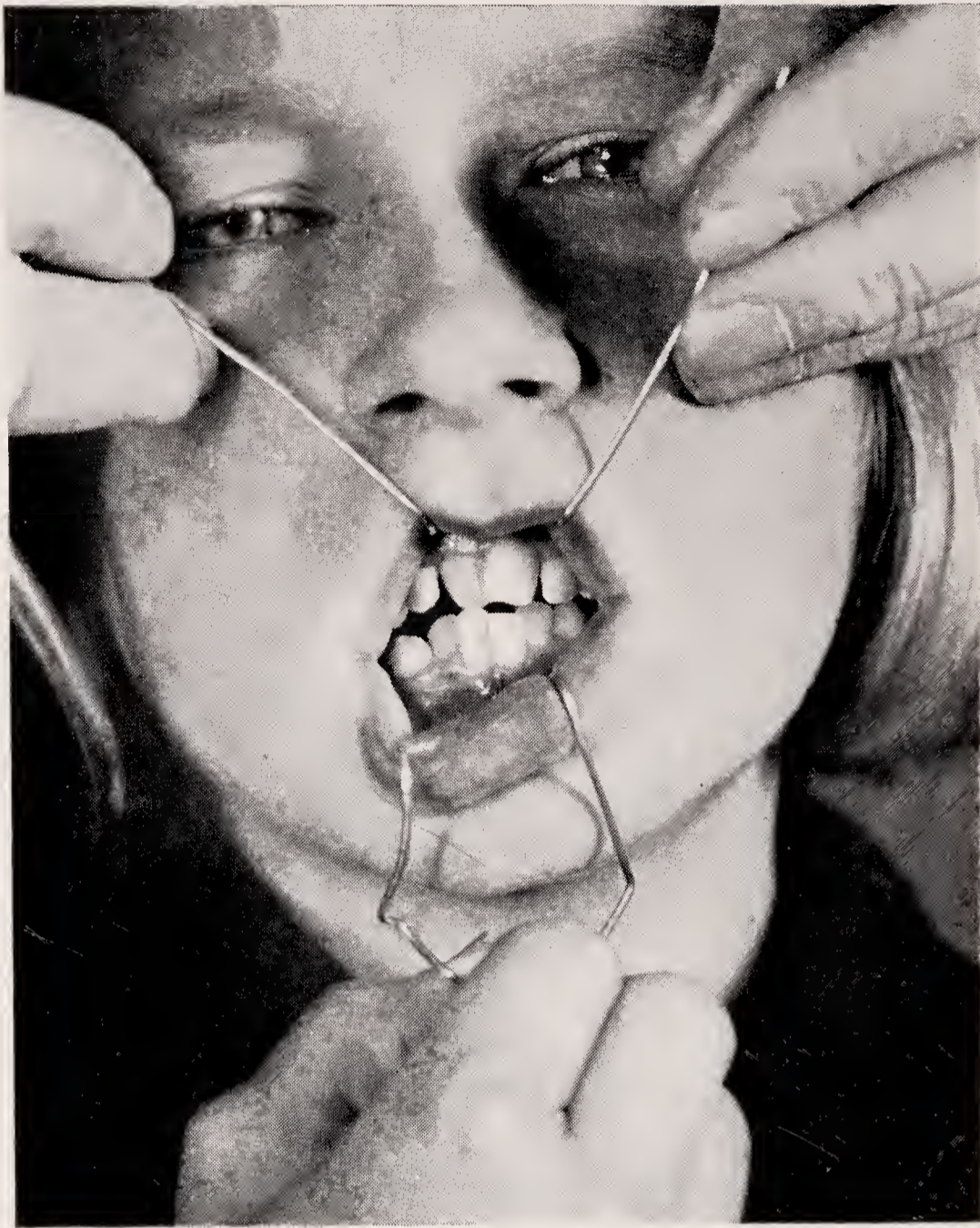
By W. TREVOR JOHNSON, L.D.S. (Eng.)

The Study of Identical twins is of assistance in estimating the relative contributions of heredity and environment as factors in development. They are derived from a single fertilized ovum and at the cleavage stage the mass of cells divides into two parts. Thereafter, these two parts continue their development as separate individuals, but they possess identical factors for all characters which are inherited. Often marked differences are found in the arrangement of teeth in identical twins and we can regard these as variations influenced by environment ; or, as I believe Prof. Harris will be explaining to us, they may be due to accidental changes or "mutation".

These particular twins are examples of a form of abnormality described by Mr. Sowden Hills in a paper read before this Society in February, 1939. They are females and their age is 10 years 7 months. There is nothing of importance to us to report on their family history, and their size and general proportions are normal for the age. When they were photographed they were asked to relax and then slowly to close the jaws. These two slides shew how in one twin one upper incisor meets the lower incisors edge to edge and in the other twin, three lower incisors meet the upper incisors edge to edge. In the twins the upper and lower cheek teeth do not meet in this position of closure, but if the wrongly inclined upper incisors could be moved out of the way, the cheek teeth would then meet, and the head of the condyle would then rest in the glenoid fossa. This would be the correct occlusion for the individual. But what actually happens is, the jaws close and the mandible is guided forward until the cheek teeth meet. The linguallly inclined upper incisors are then locked by the lower incisors and the head of the condyle rests on the eminentia articularis.

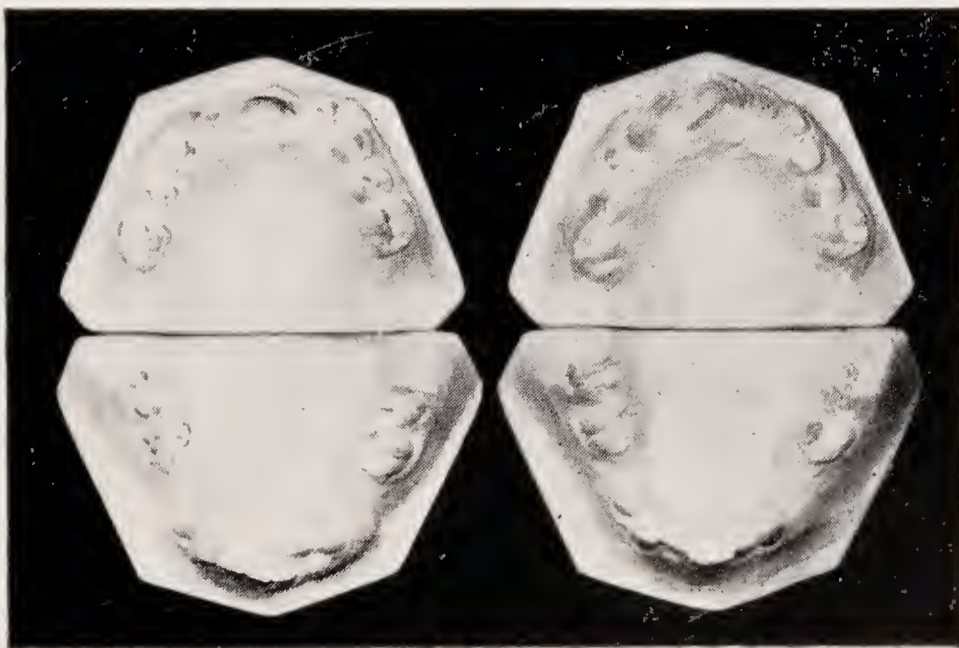
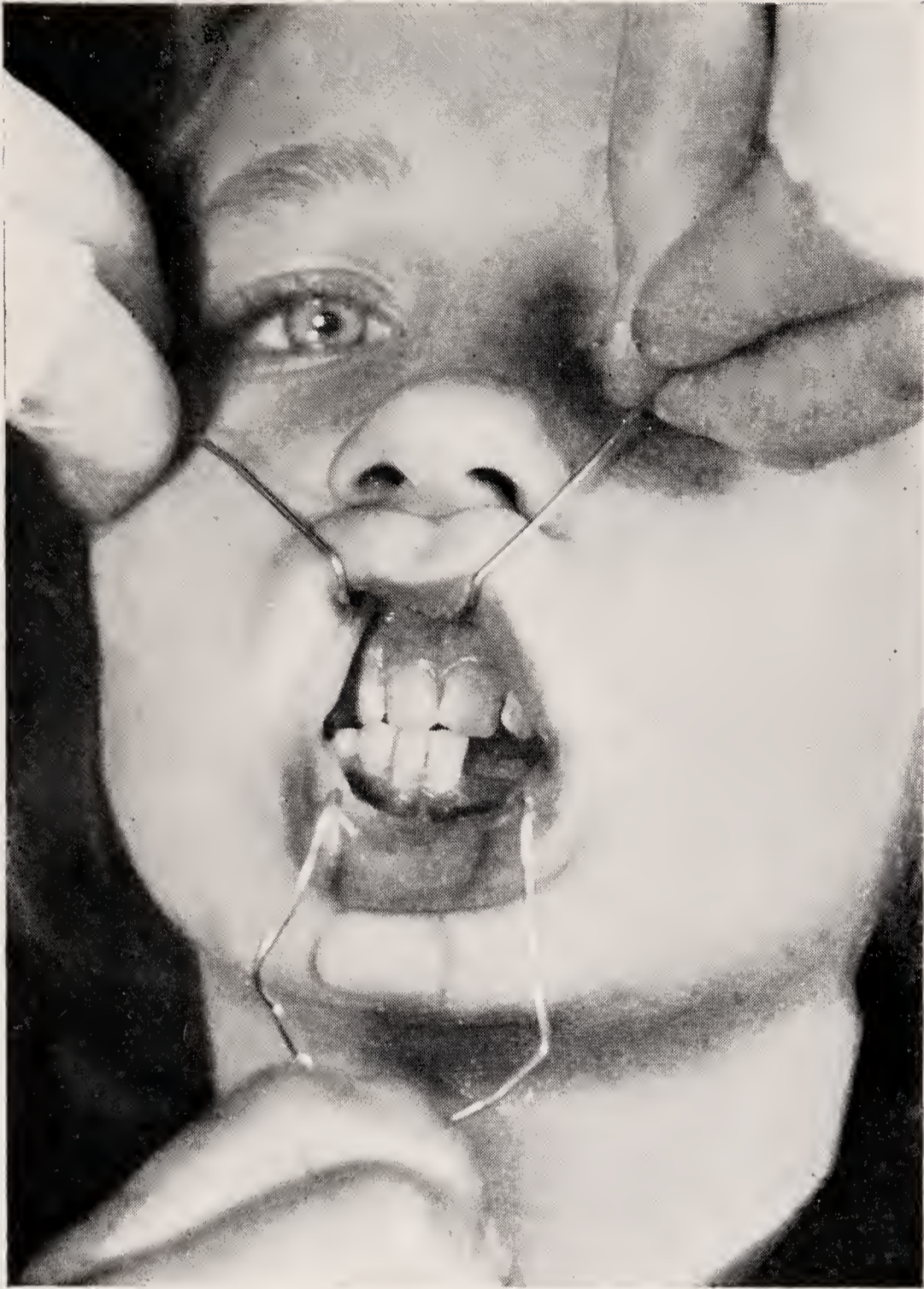
For convenience, the twin with the one tooth locked linguallly will be called "Twin 1" and the one with the three teeth locked "Twin 3". The next slide shows the two sets of models articulated in this position.

Mr. Sowden Hills is correct in many of his conclusions, and there can be no doubt that in those cases where the loss of deciduous molars is extensive, the forward movement of the mandible is secondary to cusp interferences in the deciduous canine or incisor areas ; but it is unlikely that this is the whole story. The particular



form of abnormality is only found in 6 per cent of all cases in which early loss occurs, and this being so, it would appear that we should look for the other factors which contribute to the circumstances which determine whether or not abnormality ensues. Other environmental factors may be operating but on this occasion we will speculate on the part heredity might play. Is it possible that in the inherited pattern some of the incisors are predetermined to erupt lingually and that this is the beginning of the disturbance? In some Class I cases the same forward position of the mandible with locked incisors is found with no early loss of deciduous molars. What is the etiology in this instance and has it ever been found in parent and offspring? Also similar variation in inclination of upper incisors is a characteristic of the Angle Class II div. 2 abnormality, but with no locking of the incisors and presumably this is because the mandible is more distally placed. The Angle Class II div. 2 disturbance does certainly, I think, run in families.

The next slide is a morsal view of both sets of models. In Twin No. 1 the lower deciduous molars were extracted at the age of 3.7; the upper second deciduous molars were extracted at age 7.3; and the lower deciduous lateral incisors and canines at 8.8. In Twin No. 3 the date of the extraction of the lower deciduous molars





is not known. The upper deciduous canines and first deciduous molars and the upper left second deciduous molars were extracted at age 8.7 ; and the upper right second deciduous molar and the lower left deciduous lateral incisor were extracted at age 9.10. It would seem the marked difference between the Twins is the early loss of the cheek teeth in the maxilla in Twin 3, and the absence of this factor in Twin 1, and this may have influenced the greater disturbance in the former case. At our last Demonstration Meeting, Mr. Rix shewed us instances where extraction of permanent teeth in the upper cheek teeth areas had resulted in a lessening of the overbite. This suggests a slowing up of the forward growth in the maxilla in relation to the mandible and it will be of interest to know, or observe, if this occurs in some cases if upper deciduous teeth are extracted. A definite slowing up in the mandible, if deciduous cheek teeth are extracted, is very common. If a line is drawn on the models of both twins connecting the medial contact points of the upper first permanent molars and a measurement taken at right angles to this to a point located at the middle of the lingual gingival line of the upper central incisor, it is found to be 2.0 mm. less in Twin 3 than in Twin 1.

If both these twins had shown the deformity, and only one of them had lost teeth early, we should then have had some evidence for a theory that heredity is an important factor ; but what I have offered is only speculation and more cases must be investigated.



The First Northcroft Memorial Lecture

FACTORS CONCERNED IN THE GROWTH AND DEVELOPMENT OF THE JAWS AND TEETH

By

JOHN E. HARRIS, (Professor of Zoology, University of Bristol)

It is pure presumption on my part to attempt to deliver a lecture on this topic, as I am neither geneticist, embryologist nor endocrinologist. My knowledge of vertebrate teeth is limited to that of the ordinary teaching zoologist, and I have but a nodding acquaintance with a few of the many excellent contributions to the scientific literature on dental growth and development. My friends, Mr. Trevor Johnson and Mrs. Lindsay, have done their best to enlighten me on this last point, but it must be confessed with little success—not, I hasten to add, from any lack of enthusiasm and co-operation on their part.

What I have therefore tried to do is to speculate on this whole problem in very general terms—so general perhaps as to be of little practical value to those working in this fascinating field of orthodontics. This is therefore not an original contribution to scientific research in the subject, but is intended to point out some relevant results of recent researches in widely scattered fields of biological science, and to suggest possible lines for future investigations into dental problems.

Genetic factors in the phylogeny of teeth and jaws.

From the point of view of the general zoologist the jaws and teeth can be considered as having separate evolutionary origins—the jaws from the endoskeletal supports to the primitive pharyngeal gill slits, the teeth from the exoskeletal placoid scales. The form of the teeth must very early have been modified from that of the external scales—this is true even in the most primitive sharks such as *Cladoseleache*, though the teeth and scales of a new genus (also from the Cleveland shale) which I am at present studying are very similar in form. At all events, the widely separate phylogenetic (and embryonic) origins of the jaws and teeth would lead one to expect a considerable degree of independence of genetic control over the two, however closely they may become associated in the higher vertebrates. It is clear that this is confirmed by dental studies on man, where there is often a surprising lack of correlation between the size and structure of the jaw and that of the teeth borne upon it.

A recent paper by Parrington (1947) on the teeth of *Microcleptes* is worth mentioning here. One of the earliest mammals, this Jurassic genus possessed teeth with a unique U-shaped ridge of cusps. Though no jaws have been found, Parrington points out

that the only way two such teeth can occlude successfully is for the U's in the upper and lower jaw to be opposed in direction. The deduction that the antero-posterior tooth axis in the upper jaw is homologous with the postero-anterior axis in the lower jaw is in agreement with the phylogenetic origin of the V-shaped jaw from the folding of an original single element, and it is clear that such a result has important repercussions on the interpretation of tooth cusp homologies.

The theories of Butler (1939) on the subject of molar tooth patterns in primitive mammals are also of interest in this field. As a result of a study of the very large collection of early mammalian teeth and skulls in the American Museum of Natural History, he has suggested that there is a fundamental relationship in the tooth patterns of premolars and molars, which is expressed by a gradient of a molarisation process rising towards the posterior teeth. The morphological transition from a premolar to a molar cusp pattern is found to occur at different positions along the tooth series in different groups of mammals. This transition is not therefore connected with the replacement of a deciduous molar by a premolar—a replacement which in man is presumably governed by some independent morphogenetic process. Butler visualises a number, perhaps three, of these morphogenetic pattern factors (corresponding with the incisors, canines and molars) which overlap in their effects and determine between them the pattern of the tooth series—it is perhaps permissible to consider these three factors as the basic genes of tooth crown pattern.

The fact that calcification of the permanent molars precedes that of the (permanent) premolars, might be assumed to be connected with the delay in eruption of the premolars consequent upon the replacement process. Yet the fact remains that the order of calcification of the "series," including the deciduous dentition plus the first, second and third permanent molars shows a definite transition from the anterior to the posterior part of the jaw. It confirms the anatomical evidence that M_1 , M_2 and M_3 are in reality part of a delayed deciduous dentition and are not homologous with the remaining permanent teeth. The root and cusp pattern of the permanent molars also simulates closely that of the deciduous molars, and a single genetic factor or group of factors probably controls the whole.

The occurrence of additional cusps such as the Carabelli tubercle on some members of the deciduous and permanent molar series presents an interesting problem. The fact that the Carabelli tubercle occurs on teeth which probably have a common genotypic pattern suggests that the abnormality is also genetic in origin. Nevertheless, it occurs most commonly on the second deciduous and first permanent molar, being less common on the first deciduous and absent from the second permanent molar, which suggests that its occurrence is governed by the time of formation of the tooth germ—being limited to those molar teeth whose germs are formed during foetal life.

The time factor in gene action is one of which we know very little and on which work on tooth development might throw a great deal of light. If we are dealing with a number of structures which all attain exactly the same stage of development at the same time, it would only be necessary to assume that the gene or genes for a

particular pattern of cusps or roots came into action at some critical stage to provide for the similar development of form in, for example, the whole molar series. But this is obviously not the case. It is difficult if not impossible to imagine that the pattern of the second permanent molar is determined simultaneously with that not only of the first but with that of the deciduous molars which so closely resemble it. Such an hypothesis implies that the cusp pattern of the molars is determined at least during the early months of foetal life before many of the germs are detectable. This is stating a rather obvious fact, but it links up with a good deal of modern work on the action of organisers which may be referred to here.

The concept of an organiser, first introduced in the classical work of Spemann (1924), is well known. A whole hierarchy of primary, secondary and tertiary organisers has been established. The primary organiser (presumptive mesoderm from the dorsal lip of the blastopore) induces the formation of the embryonic axis; subsequently, one of the regions so differentiated (the head endoderm) serves as a secondary organiser acting on the overlying tissues so as to produce teeth. It is, however, not sufficient for the appropriate organiser to be present; the tissue on which it acts must be in an appropriate condition to react—a state which has been described as “competence.” Thus tissue both in the blastula stage and in the later stages of embryonic development does not give any induction with the primary organiser. It has been shown, however, that in any tissue, competence to react extends over an appreciably longer time interval than that during which the organiser acts upon it in normal development. In the production of a tooth germ, however, the reverse may be true. The morphogenetic stimulus for tooth form must be present throughout the period when developing tooth germs are present—though it may not be present in all parts of the mouth throughout this period, but be localised in or near the tooth germ which is competent to react to it.

Work on this subject has only been carried out so far on the development of arthropod eyes. The effect of short periods of abnormal external stimuli (high temperature) at different phases of the life history has provided a picture of the sequence of operation of a system of genes similar to the establishment of the primary, secondary and tertiary organisers described above. It would be more difficult to work on mammalian material, but exceedingly profitable if it could be tackled successfully.

Why, incidentally, does the premolar develop an entirely different tooth pattern from the deciduous molar which precedes it? It is laid down within the period of development of the molar series and might be expected to be subjected to the same genetic influences. Two answers might be given to this question. One is that environmental conditions (the previous growth of the deciduous molar) have inhibited its development. The other possibility is that there is a fundamental distinction between the first dentition and the second. The anatomical evidence in man seems inconclusive on this point, but Parrington's (1936) work on tooth replacement in the theriodont reptiles appears to support Bolk's (1922) contention that we are dealing with the replacement of an exostichos by an endostichos—i.e., with teeth developed from different origins in the dental lamina. This work seems to have attracted less attention than it deserves, since it links up the problem of tooth replacement

not only of the reptiles and mammals, but also of the pre-reptilian ancestors as far back as the osteolepid fishes.

If the deciduous dentition and the permanent molars are derivatives of Bolk's parietal row, whilst the remainder of the permanent dentition grows from the terminal row, it may be that competence to react to the "molarisation" factor may be limited to the terminal row (exostichos).

Trend evolution in the jaws.

One of the rather fascinating problems which confronts the student of dental abnormalities is of course the frequency with which these occur at the present day, as compared apparently with that in pre-historic times—and indeed even within less distant periods. It has been suggested that there is a general decrease in jaw size as human evolution progresses—without an equally marked reduction in tooth size. Perhaps because the orthodontist spends so much of his time mechanically changing the form of the dental arch, he tends to consider seriously the possibility that this change in jaw size may not be genetic but environmental in origin—caused by the different feeding habits of modern man. Bennett (1931) rightly points out that since the Lamarckian view is largely discredited, such an hypothesis would mean that the smaller jaw was formed *de novo* in each generation, unless the selective advantage of the larger jaw had disappeared. He quotes an argument of Weismann that in the absence of selection, "panmixia" brings in its train the degeneration of the useless structure. The argument, as Weismann, put it, is incomplete and must be brought into line with present day mutation theory.

The occurrence of a visible heritable abnormality (assumed to be a homozygous recessive condition) to an extent of only one per thousand in the population corresponds with the possession of this recessive gene in the heterozygous form by more than 6 per cent. of the population. In other words, we are fairly safe in assuming that such recessive genes are present in a very high proportion of people. If selective pressure acts to any appreciable extent against a person possessing this abnormality, it would be gradually but surely eliminated until an equilibrium was reached between the mutation rate (producing new occurrences of this recessive from the normal gene) and the selection pressure. This equilibrium, for any normal mutation rate, occurs at a very low frequency of occurrence of the recessive in the population as a whole. There is no good reason for supposing that the mutation rates for genes controlling dental growth are of a higher order than those found in all other laboratory studies, so that we are forced to conclude either (1) that our present population is in the later stages of evolving a dominant "normal" type from an earlier "abnormal" recessive ancestral form or (2) that selection pressure is not acting on the system at all. The first hypothesis is controverted by paleontological evidence, and is obviously very unlikely. We are therefore left with the second. The case is analogous to that of the evolution of eyeless races of cave-dwelling animals. Waddington (1939) points out that it is usual to find that the highest mutation rate at any locus is to a hypomorphic allelomorph determining a reduction from the normal size. The accumulation of such hypomorphs can thus proceed indefinitely where selection pressure does not exist.

It is not perhaps unreasonable to assume that our diet nowadays makes so few demands on our dentition that this state of affairs actually exists—though if so it suggests that opportunities for the practice of orthodontics will increase. In geological ages yet to come we may expect to find dental surgeries as common as public houses—and with universal orthodontic treatment, even the very slight disadvantage of a malformed dental arch in the competition for acquiring a mate will be wiped out.

The effect of endocrine factors on dental relationships.

I have discussed at some length a few of the genetical problems which may be concerned in dental development ; what of other factors ?

It would be rash and unnecessary for me to attempt to deal with purely extrinsic factors involving the action of mechanical forces, whether by harmful appliances like infant comforters or remedial ones such as those used by the dental surgeon. This is your field of work, and I am very greatly impressed by the results of it as seen in the dental literature. It is however worth adding a few remarks about hormonal effects.

I believe that the primary effect of endocrine variations on arch relationships is likely to be small. The influence of a hormone is highly specific but, if one may draw a mathematical analogy, within that specific field it is likely to have a scalar rather than a vector effect. This statement may be explained by reference once again to the organiser concept. The dorsal lip of the blastopore in an amphibian embryo, grafted under a piece of competent but undifferentiated ectoderm produces a normal embryonic axis differentiated into a head and trunk end, so that the organiser possesses directional properties of induction. On the other hand, boiled organiser tissue, or certain synthetic carcinogenic substances grafted in a similar manner, induce neural tube or sphere formation in an ectodermal sheet without any trace of axial differentiation. A distinction is thus drawn between the effects of an organiser—regional determination—and those of an evocator—non-regional induction.

The action of a hormone, e.g., in bone formation, is much more likely to correspond to that of the evocator in embryology. It may initiate a response and determine the scale of the response, but will be unlikely to affect the mutual relationships of structures which by their nature are likely to be similarly affected both qualitatively and quantitatively by the hormone. The size of both maxilla and mandible may be changed without substantially altering the arch relationships.

This suggestion is borne out by the work of Downs (1928) who investigated the occurrence of dental anomalies in 647 cases, of which 376 showed clear cut clinical symptoms of endocrine disturbance. Though the incidence of dental anomalies was appreciably higher among those with endocrine dyscrasias, there was no obvious relationship of a particular type of anomaly with a particular form of endocrine disturbance.

The possibility of random variations.

It is well known that “ accidents ” in embryonic cell division can lead to the production of organisms, e.g., insects, which are

partly male and partly female—all the cells in one part of the body possessing one more or one fewer chromosomes than those in the rest. Mosaics of this type are rare. A second type of mosaic is that found by Goldschmidt (1938) in his work on the moth *Lymantria*, where intersexes occur which are phenotypic mosaics—the result of a switch over in the whole insect during development from male to female development or vice versa. The time at which the switch over takes place will determine the balance of the system finally attained.

The reason I have mentioned this work is that it suggests to my mind the possibility of abnormalities arising neither from hereditary nor environmental causes but from random accidents in the course of development. The time scale of events in the development and eruption of a set of teeth is so carefully balanced—and yet the process must be determined long before the actual events take place that one is tempted to consider the possibility of accidental variations not environmentally determined. Mr. Trevor Johnson's interesting example of a difference in the delayed eruption between a pair of identical twins may be for all we know a case of accidental variation.

The quantitative study of form.

One of the difficulties of expressing with precision changes in form is to provide the set of parameters to be used in describing the form in question. To give an obvious illustration—the size of a circle is completely specified by a single parameter, the radius ; that of a rectangle or ellipse by two parameters—those of length and breadth. Though curves such as the parabola and hyperbola appear more complicated in shape they can still be described mathematically in terms of two parameters.

If, however, we are dealing with a structure such as the mandible as a three dimensional solid, it is obvious that a complete mathematical description of the form of this bone would require a very large number of parameters. It should be noted that we are at liberty to choose among possible parameters, but that the number required completely to specify the form is always the same—a circle is completely specified *either* by the radius, *or* by the circumference *or* by the area—the ellipse *either* by the major and minor axis *or* by the area and one of the principal axes, *or* by the distance between the foci and one of the principal axes, etc.

Turning now to the genetical problem—how many genes are required to produce the mandible in its observed form ? It would be fantastic and unnecessary to assume that for every bone in the skull a set of genes exists equal to the number of parameters required mathematically to describe its form—the gene apparatus would run into millions. Put the question in another way. Considered from the point of view of skeletal organisation alone—how many gene differences are there between the mandible of a horse and that of a tapir ?

The question admits of no precise answer—but in view of the very striking mathematical results illustrated in Thompson's (1942) analysis it can be greatly simplified. If the side view of a horse's skull is drawn against a background of rectangular co-ordinates and the corresponding points of a similar view of the tapir's skull are then used to construct a second set of co-ordinates,

it will be found that the differences in form reduce to a transformation of the co-ordinate system. This transformation is itself capable of description in terms of only a few parameters—however complex may be the mathematical description of either skull as a whole. The number of parameters required to describe the transformation may reasonably be taken as the *maximum* number of factor (or gene) differences between the two skulls.

Simpson (1944) in his “Tempo and Mode of Evolution,” has given a striking illustration of this. He points out that the relationship of muzzle to cranium in the evolution from the primitive horse ancestor *Hyracotherium* to the modern *Equus* is a heterogonic one. The sizes of the two parts are related in a simple logarithmic fashion so that their growth rates are strictly proportional. This means that in spite of the apparent difference in relative proportions between the two skulls, the genetic basis of this growth process did not change throughout the 45,000,000 years that elapsed.

The connection between this discussion and problems of facial development is obvious. Comparison between the jaws of the growing child and the adult appears in orthodontic literature to be achieved by a rather artificial system of reference points and axes chosen for convenience of measurement—such factors as length, height, etc.—or on the basis of the apparent constancy of certain relationships, e.g., the use of the anterior border of the ascending ramus as a vertical reference plane—a procedure which it is admitted appears well justified on the basis of Brash’s (1924) work. I suggest however that it would be worth while to investigate the possibilities of using the co-ordinate mapping method of Thompson to see what is the simplest number of parameters required to describe the change in form of (say) the mandible during growth and to see how far disturbances in occlusion, etc., can be fitted into this system of transformations. I have not attempted to do this myself, as the location of the corresponding points in the juvenile (or foetal) and adult jaw is a job for one well versed in dental anatomy.

Such an analysis, applied to a simple case of malocclusion, should give us some idea of the minimum genetical disturbance involved in a case of *hereditary* malocclusion. More complicated “environmental” disturbances in occlusal relationships could then be investigated to see how they differ from the conditions encountered above. Statements such as “The lower teeth move downwards and forwards, the upper ones slightly upwards and forwards,” might be found to be as redundant as saying that “square A is twice as long and twice as wide as square B”—all the movements may be expressions of a single type of growth pattern.

A representation of the pattern of the whole skull on such a system of co-ordinates might well reveal some of the factors concerned in jaw reduction. The fact that the jaws of present day man are generally smaller than those of early man may be nothing but an extension of the process which has been going on almost through the whole of vertebrate evolution and which is emphasised by Gregory (1929). This is the reduction in the face, particularly in the jaws, concomitant with an increase in brain size. It is possible to assume that the genetic factors involved in the two were largely separate, and that the fact that the changes were linked together was brought about by the action of natural selection. But it is equally possible that we are dealing with a single change in

the relative sizes of the two parts of the skull. This would be revealed by the co-ordinate transformation, which would show whether there was any gross discontinuity in the change of form of the jaws as compared with that of the rest of the skull. Certainly in the case of the evolution of the horse quoted above, there is no need to postulate an independent factor for the elongation of the jaws since the co-ordinate transformation is a relatively simple one over the whole skull picture.

If the growth of the brain case is heterogonic with respect to the jaws, we should expect to find a continuous reduction in jaw size accompanying an increase in cranial capacity, unless the reduction in the jaws became significantly disadvantageous. The case is in fact the converse of the *Hyracotherium-Equus* evolution described above.

The biochemical genetics of form.

The biochemical relationship of the gene as an enzyme precursor to the simple presence or absence of a particular reaction is now well understood. Starting with the work of Scott-Moncrieff (1936) on the inheritance of anthocyanin pigments in flowers, where a single mendelian factor corresponds to a particular side chain or other simple chemical modification of the pigment molecule, the more recent work of Beadle, Tatum *et al* (see Horowitz, 1945) has provided a genetical basis for the normal essential metabolic enzymes. "Lethal" genes in the mould, *Neurospora*, have been shown by these workers to correspond exactly with the absence of enzymes required for certain definite stages in the synthesis of essential amino acids from inorganic sources. In the presence of the appropriate amino acid in the culture medium, free growth of the "lethal" modification will occur. The work of Caspersson, Brachet (1944) and others is slowly but surely unravelling the mechanism by which the enzyme is provided from the gene, and thus the links between the gene and its metabolic effects are being discovered. Little, however, has been done on the precise connection between form and the gene or genes which produce variations in it. You will pardon me if I have to quote an example from a field completely outside dental studies—and indeed not even in the vertebrates, since it is one of the few clearly established examples of this connection.

Mutations of the fruit fly *Drosophila* affecting the shape and form of the minute bristles on the body have long been known and their gene loci and effects in combination have been fully worked out. The recent important work of Lees and Picken (1944), however, is significant, because for the first time it relates unequivocally the form of the normal and abnormal bristles to two clearly defined "rate" processes, genetically controlled. The growth of a bristle takes place by the lengthening of a hollow cylindrical sheath, inside which is being simultaneously produced a secretion at the base which "fills up" the hollow as fast as it grows. The normal bristle is only produced when these two independent processes keep in step—a change in the rate of either produces abnormalities which are easily understood on the basis of the physical properties of the two components. The appearance of short, long, swollen and even of curved and forked bristles is explained by variations in the rate of production of these two simple constituents. The relationship

of this type of work to orthodontic studies is less obvious, since its application is more to the form of the tooth itself than the jaws. One would like to see a laboratory study made of the embryonic development of genetic abnormalities of tooth form (and replacement) coupled with careful histological studies of the arrangement and structure of the dental lamina and the enamel organ.

Conclusions.

The human jaws and teeth form an exceedingly complex unit ; one which is considerably affected during growth by accidental or deliberate extrinsic factors. Nevertheless it is probably true to say that no one unit of the human body lends itself so well to a quantitative and qualitative description of its complexities throughout the greater part of the life history of the organism. There is clearly an immense field of highly profitable research into human genetics here. Detailed studies of the dental anatomy of identical twins, and of selected families should be undertaken on the largest practicable scale. The methods employed by Wingate Todd at the Brush Foundation at Cleveland, Ohio, seem to me a model of the type of work which should be done on these lines. His early death robbed the Foundation of an immense source of energy and enthusiasm which is only too rare. A project such as his of continuous detailed physical examinations at 6-monthly intervals, if it could be carried out over two or three generations, would establish human genetics on an altogether broader or firmer basis than it has at present.

Dental practitioners themselves are obviously in a position to make a significant contribution to this type of work. The results which can be obtained from the family unit with which the practitioner normally deals are very valuable source material for the research student—if there is not one already, there should be some central organisation prepared to accept and classify casts and data for use in research projects. I should also like to emphasise one branch of study which I feel would break much new ground—an immense increase is needed in the study of tooth development in the laboratory by *in vitro* methods. The technique of tissue culture has made great strides in the last twenty years and the possibilities of its application to the developing tooth germ and even to the jaws themselves are very great indeed. Glasstone (1938) has pioneered some work in England on these lines, but her work is the only example known to me. With modern histochemical methods including such techniques as the phosphatase localisation tests and the possible use of radioactive tracer elements a new chapter in dental research is waiting to be opened.

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In introducing his subject, **Prof. J. E. Harris** said: Your Society has done me a signal honour by asking me to give the first Northcroft Memorial Lecture. It is also a considerable embarrassment to me because I have very little claim to specialised knowledge on this subject. Perhaps I ought to apologise for the fact that what I have to say has much more to do with teeth than with jaws and therefore is perhaps less orthodontic than it should be, but that is the line along which my own interests lie.

Figures 1 and 2 illustrate Parrington's (1947) contribution to the structure of some very early mammalian teeth, (the group including *Microcleptes*), in which the cusp form is most unusual. The cusps form a U-shaped area which is closed at one end so that the occlusal relationships of these teeth make the U's of the upper and lower jaws fit in opposite directions. This suggests that cusp homologies in the upper and lower jaws are reversed in the mesio-distal direction.

Figures 3 and 4 are taken from the interesting series of papers by Butler (1939) on the evolution of molar tooth pattern in primitive animals. He suggests that the cusp and root patterns which appear in the teeth of mammals are derived from a series of influences (which we may assume are genetic in origin), acting over whole areas of the jaws and not on individual teeth. He assumes that in the jaws there are at least three such influences which can be called molarisation, incisivisation, and caninisation, acting on teeth to cause the kind of tooth pattern which is produced. Figure 3 shows that the effect is not uniform in intensity, but increases in the incisivisation factor towards the centre and in the molarisation factor towards the posterior part of the jaw. Butler has shown (Fig. 4) that the point at which the molarisation gradient attains its maximum occurs at different levels in the dentition in different animals.

Figure 5, also taken from Butler's work, shows that the length of the molar region in some of the primitive mammals is mathematically related to the length of the jaw as a whole over very wide ranges of jaw length and total molar length. Evidently there is some factor determining the molar region as a whole, rather than an individual factor for each tooth.

I wondered whether this had an application to orthodontic practice, because I came across a note by Mr. Harold Chapman on a study of closebite, in which he suggested the phenomenon was

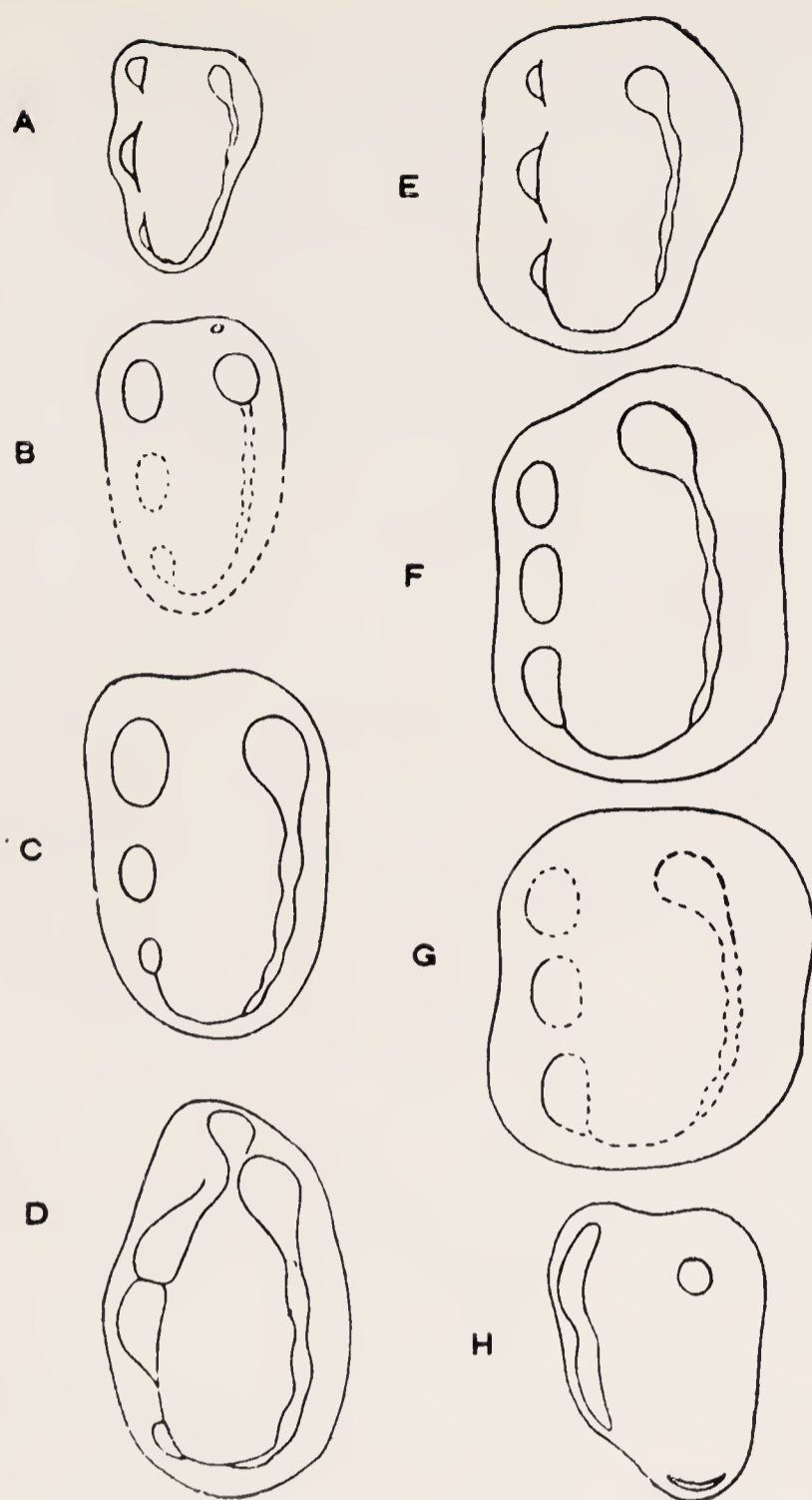


Fig. 1. Diagrams of microcleptid teeth showing U-shaped pattern of cusps (from Parrington, 1947).

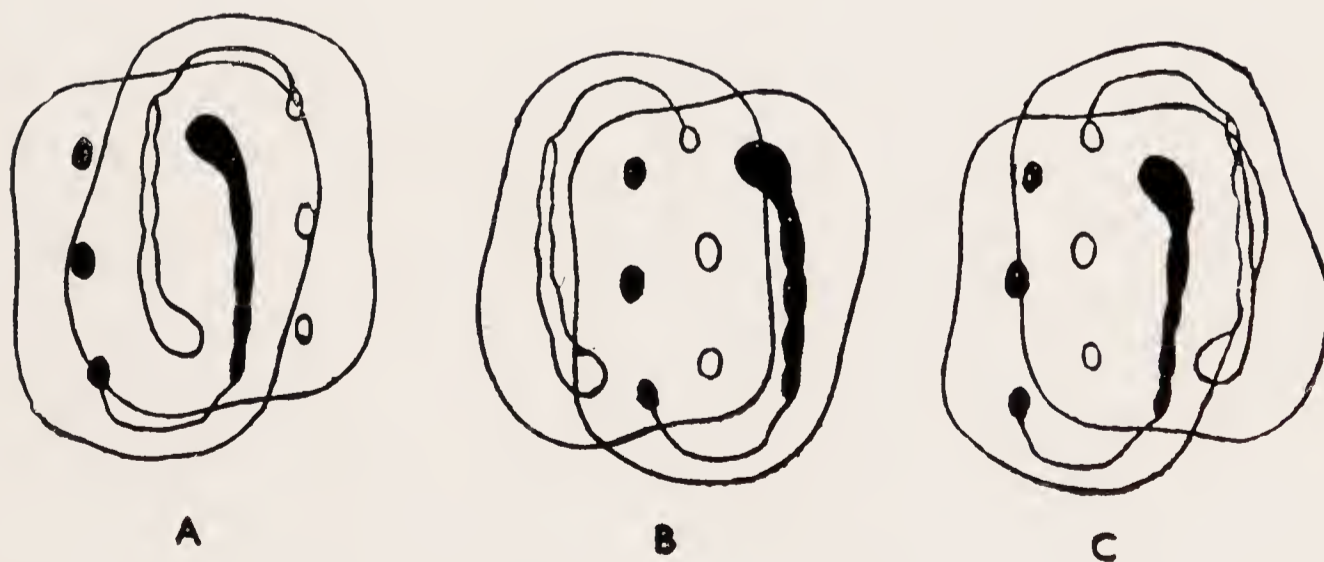


Fig. 2. Possible occlusal relationships of microcleptid teeth (from Parrington, 1947).

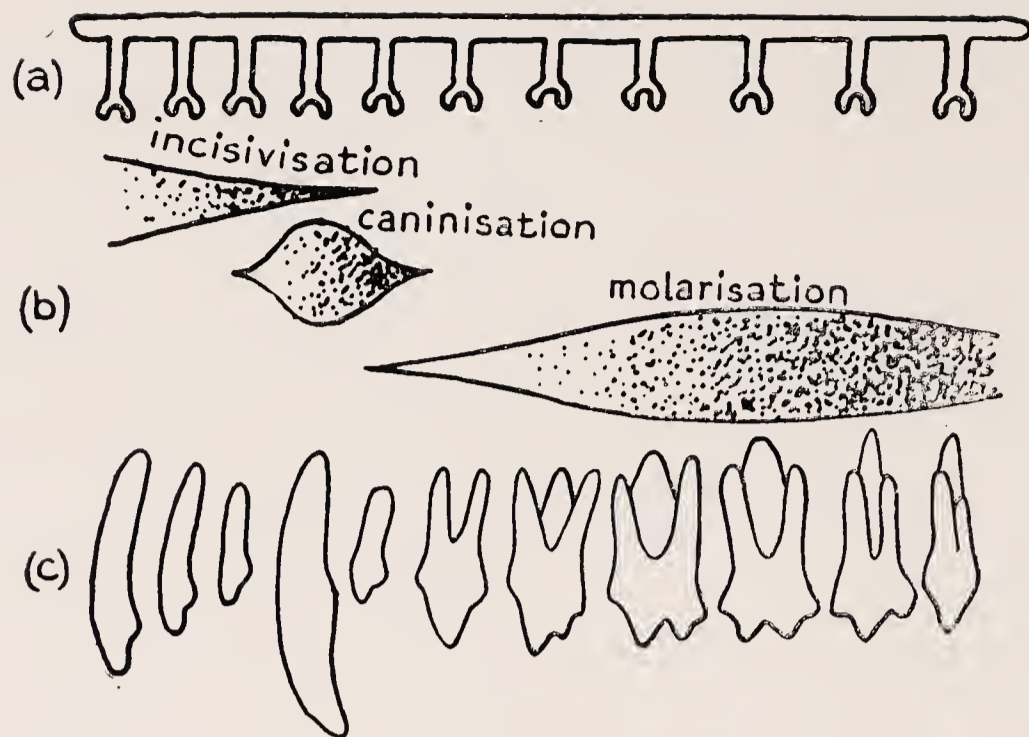


Fig. 3. A representation of the morphogenetic fields which may be concerned in tooth pattern differentiation. (from Butler, 1939).

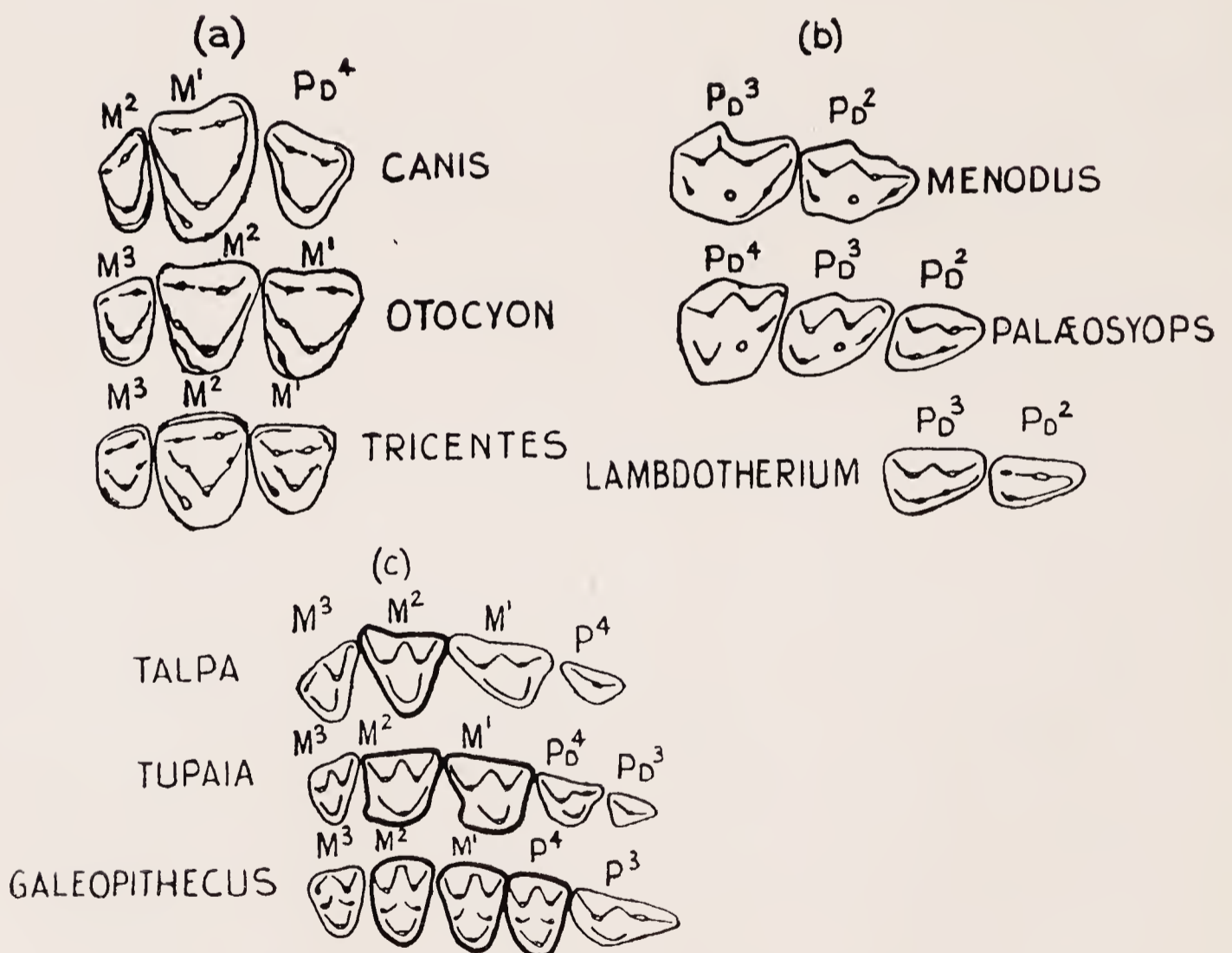


Fig. 4. Changes in the region at which the molarisation field attains its maximum. (a) Note the correspondence between M_1 of Canis and M_2 of Tricentes. (b) Increased molarisation of the second deciduous molar in the evolution of Titanotheres. (c) Extension of the molar region into the premolar dentition in Insectivores. (from Butler, 1939).

due to differential vertical growth in different parts of the jaws. It occurred to me that perhaps differential growth of the alveolar and basal bone in different parts of the jaw might be associated with these different regions which Butler postulates.

We can consider these three processes as the basic gene characteristics of tooth pattern, and there is, of course, a certain amount of evidence which would support the suggestion that the factors responsible for the molar pattern, for instance, along the whole series are not formed in each tooth individually. I would draw your attention to the fact that the deciduous molars form a perfectly good series with the permanent molars and one should consider them both as part of the same tooth series.

The occurrence of accessory cusps, such as the Carabelli tubercle, in human teeth raises the question of the time of action of some of the genetic influences which determine such things as cusp pattern. We are dealing here with structures which attain their development at very different stages in the life history of the animal, and it is rather surprising to see how the action of the genes which determine their form is so adjusted as to produce similar effects at such different times in the life history.

This time factor in gene action presents an interesting analogy in experimental embryology with the action of the organiser. Far too little is known about organiser action in the development of teeth. The diagram, figure 6 and the table in figure 7 illustrate the succession of organisers which are responsible for forming the various tissues in the embryo. There is a primary organisation centre which differentiates into a head organiser and a tail organiser, the former producing head endoderm. We can have this primary organiser present together with the tissue which normally becomes teeth, but teeth will fail to develop unless the head endoderm is also present in the region.

It is, however, not sufficient merely for the proper organiser to be present for teeth to be formed. It must be present at an appropriate time in the history of the tissue on which it acts.

This is a field which I feel would much repay experimental work. If I might instance the way in which such work has been done in the past I would take the work on the insect eye. Here it has been found possible to test the effect of varying temperatures and varying external environmental factors at certain critical times in embryonic development when eye abnormalities can be produced. We might try to see at what stage of the embryo influences on tooth pattern formation are developed. It would also be interesting, of course, to find out what happens if tooth germs are transplanted to different parts of the jaw and their subsequent fate determined.

The homologies of the deciduous and permanent dentition of the mammal with the peculiar replacement mechanism existing in ancestral forms is illustrated in Figure 8.

This diagram shows teeth in a series of specimens, from small to large, of a pro-mammalian reptile; the alternate replacement can be clearly seen. Parrington (1936) pointed out that this situation recalled very strongly the replacement mechanism of teeth in still earlier forms. This work and that of Bolk (1922) suggests that there is a distinct anatomical difference of origin between the two dentitions, which might be connected with the pattern difference and with the different genetic factors determining their form.

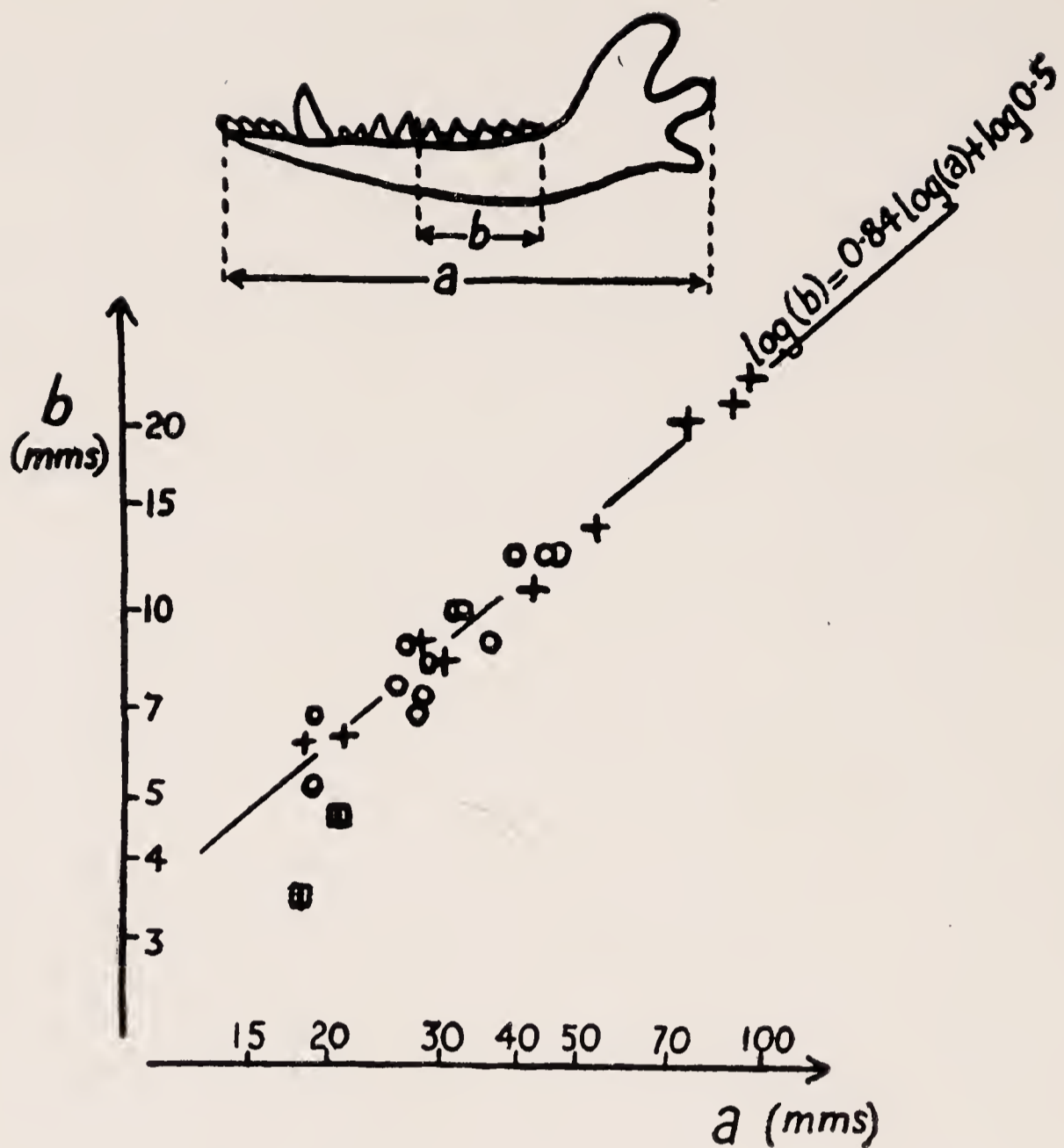


Fig. 5. Relation between length of molar series (b) and length of jaw (a) in a series of Jurassic mammals. (from Butler, 1939).

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(*Proc. Zool. Soc.* 109 B, 1, 109 B, 329.)

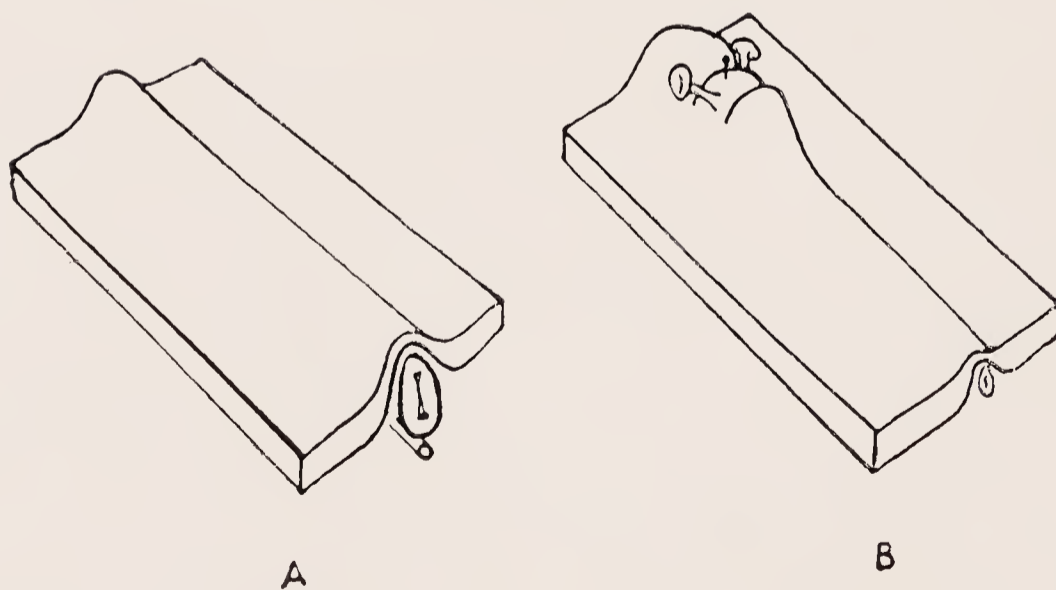


Fig. 6. Action of an organiser in producing A, a neural axis without regional differentiation; B, a neural axis with regional differentiation into a brain and spinal cord. (from Needham, 1942).

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(1942, *Biochemistry and Morphogenesis*.)

It seemed worth while to include in this talk some remarks on the trend of jaw evolution, because it is a topic discussed at some length in the orthodontic literature. In the possibly parallel condition of eyelessness in cave animals, the eyes tend to disappear not because of a Lamarckian factor, but because there is a tendency to mutate to an eyeless condition at a greater rate than the reverse process.

We are dealing with a situation in which the character eyelessness is of no disadvantage to the animal. Thus the presence of an excess of mutations in this direction will automatically tend to increase the extent of the characteristic in the population. This may well be the condition in the human race which brings about a mal-relationship between teeth and jaws. We have perhaps very little use for a beautifully adjusted tooth-jaw relationship, so that it is no disadvantage if there is not a perfect occlusion. If mutation towards a smaller size of jaw tends to occur more frequently than the reverse change, such a tendency will be perpetuated.

I have been rash enough to suggest that the effect of endocrine factors on dental relationships is not likely to be great, because it seems to me that endocrine dyscrasias are likely to result more in changes of scale than in changes of relationship between two similar bony structures. As a matter of fact there are possibilities of differences between the mandible and the maxilla, since the one is largely formed of membrane bone, whilst the other is very intimately dependent on the cartilage bone structures of the primary upper jaw, which may be differently influenced by endocrine factors.

On the whole, however, one does feel that the endocrine factor is one which can be, perhaps not neglected, but at least given a rather small importance as compared with the genetic problem in considering these relationships.

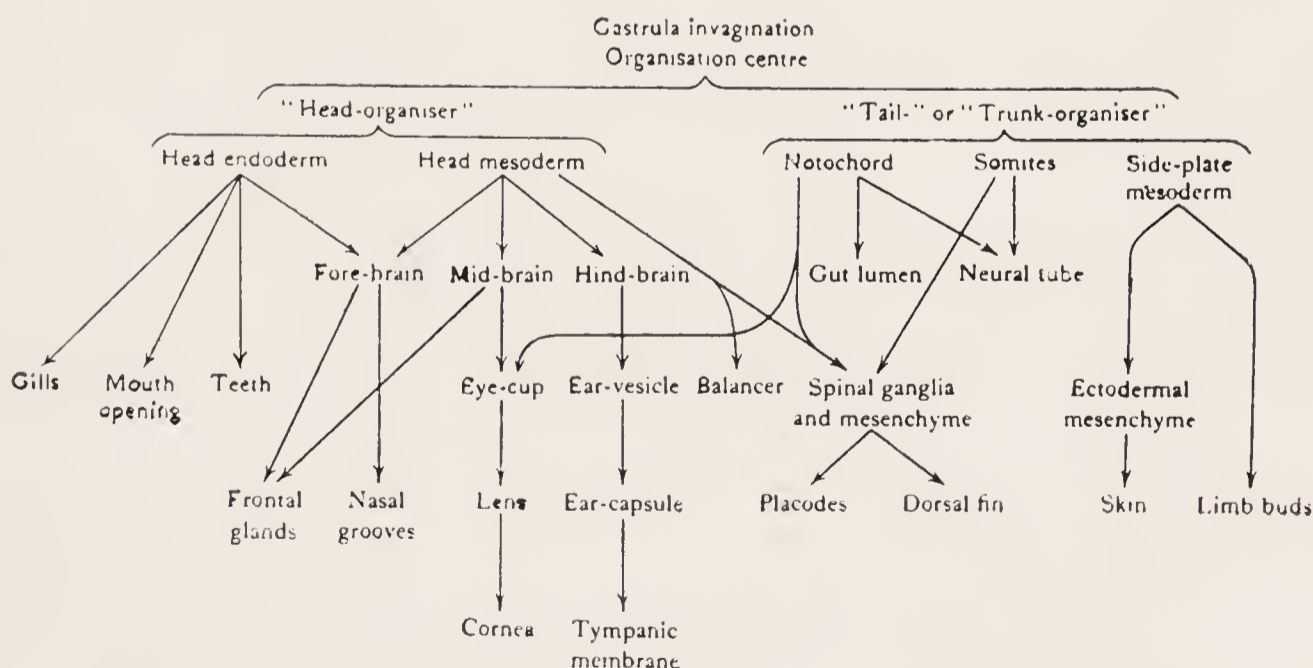


Fig. 7. The succession of organiser effects in organ differentiation
(from Needham, 1942.)

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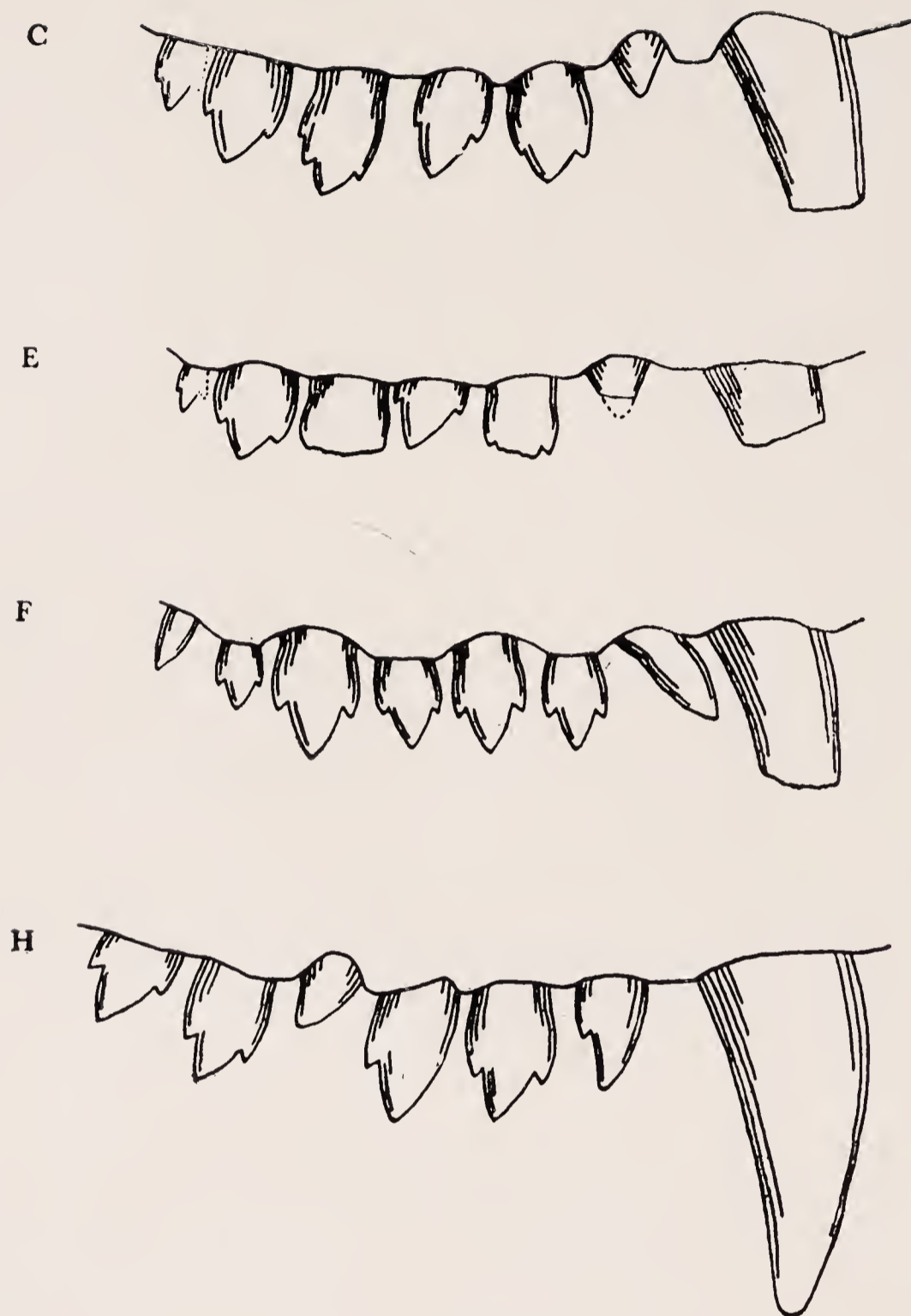


Fig. 8. Cheek teeth of four specimens of *Thrinaxodon*. Alternate replacement is clearly suggested by tooth sizes and also by emargination of the alveolar border, especially in F. (from Parrington, 1936).

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Phil. Trans. Roy. Soc. (B) **226**, 121.)

In suggesting the possibility of random variations, it seems to me that when one is dealing with so delicately balanced a system as that of dental growth and development, the possibility of accidental variations must be taken into account. By accidental variations I mean those not due to environment but those which are accidental in the same way as the movement of an individual molecule is "accidental" although the mean velocity of the total population of molecules in a gas can be predicted. This accidental variation, I feel, can apply to the teeth. The case of identical twins with upper incisors locked lingually, which Mr. Trevor Johnson described in his short communication, may be a case in point. It seems possible that one could get variations of this sort by some random difference in the time of eruption or of occlusion of two teeth. This is not a primary environmental effect, and from its manner of occurrence would of course not be inherited.

One of the lines of work which I feel might be rather profitable in investigating this dual problem has been put forward by D'Arcy Thompson in his book on "*Growth and Form*". While the mathematical description of some structures like the mandible may be impossibly complicated, yet the relationship in form between two mandibles—even from two distinct species—may be expressed in very much simpler mathematical terms; the genetic differences, if one likes to try to interpret the mathematical equations in terms of genes, may therefore themselves not be unduly complex.

This whole problem is well illustrated by the diagrams in Figures 9, 10 and 11. First a lateral view of the human skull is fitted into a system of rectangular co-ordinates. Next we have exactly the same system of co-ordinates applied to the skull of a chimpanzee; there is no striking discontinuity between the systems of co-ordinates in spite of the very great facial difference between the chimpanzee and the human being. Figure 11 shows a baboon with still greater distortion of the co-ordinates, but a distortion obviously of the same type as in the chimpanzee.

It seems to me that this method would provide us with a weapon to determine the existence and extent of certain mal-relationships which might originate outside the normal pattern of jaw and tooth morphology. The process can equally well be applied to the relationships of facial form in the foetus and in the adult. If we were to study the movement of the teeth and the changing shape of the jaws during growth in terms of general co-ordinate transformations of this sort, I wonder how far we should find the whole picture of tooth movement very considerably simplified. It seems to me that it would be a possibility well worth following up in determining the magnitude of exceptional, possibly genetic, abnormalities.

A rather striking example of this technique is given in Figure 12 taken from Simpson's (1944) recent book. This shows a logarithmic plot of the length of skull against the length of face over the whole series in the evolution of the horse from the early *Eohippus* to the modern *Equus*. The relationship of the two can be expressed by a straight line, and Simpson draws the conclusion that there has been no change in the genetic factors determining size of face relative to size of skull during the whole 45,000,000 years of horse history.

The paper includes a short note on biochemical genetics of form because it seemed to me that some ingenious orthodontist might possibly find it a stimulus for research. The work of Lees and

Picken on the growth of bristles in the insect *Drosophila* is illustrated in Figure 13. The growth of a normal bristle in one of these insects takes place by the secretion of fluid inside a cylindrical sheath. If the sheath grows "in step with" the amount of fluid secreted we get a normal bristle, but if, on the other hand, the fluid is secreted more rapidly than the cylindrical sheath builds up in length, we get distortion occurring. Lees and Picken have considered the molecular structure, the viscosity etc., of the two materials in question and they show that the rate of secretion of the two substances is almost the only factor which needs to be taken into account to explain the formation of the genetically different types of abnormal bristle. This is a line one would have liked to follow up in other biological formations, such as bone.

One is rather tempted at this stage to suggest that perhaps the fact that the wide variation in extent of malocclusion has led us to consider that it must necessarily be an extremely complex process genetically. There is evidence that, quite apart from obvious considerations of environmental effect, human height, a variable with an immense range, is determined by a very large number of genes; we tend to assume therefore that the same is true of other size variables. When however, we are dealing with a *relationship* such as that of mandible to maxilla, we may be able to eliminate many genetic factors of size which affect both jaws similarly, and it may be possible to discover a few genetic factors for malocclusion in contrast with the elaborate genetic complex determining height.

Taking Prof. Brash's data of 60 per cent of Class 2, Division 1, type of malocclusion present in the population, one might work out approximately the percentage of genes in the population, assuming in the simplest possible case that each overhung maxilla is produced by a single genetic difference. To maintain a stable population containing 60 per cent of this defect, it can be calculated that if the condition is a simple dominant one, about 13 per cent of the population would be homozygous dominant, 47 per cent heterozygous and 40 per cent homozygous recessive. This assumption is not only too simple but rather unlikely, because I find it difficult to imagine that this particular type of malocclusion can be a dominant effect; most homozygous dominants in human genetics have an almost catastrophic effect on the morphology, e.g. brachydactyly. If one assumes that it is a simple recessive abnormality one has a different set of ratios (6:34:60%) and rather better correspondence with the actual expression of the gene. It would be possible to construct a hypothetical system like this and to see how the actual proportions in the population and the proportions of offspring of various matings compared with the simple assumption. Incidentally, Gruneberg (1940) has recently reported an overhang of the maxilla in the dachshund which is inherited as a simple recessive. The rarer class 3 type malocclusion in man seems to be a dominant rather than a recessive characteristic.

Speaking as a layman in the general field, it seems to me that there is a very great opportunity in orthodontics for fundamental research. The whole problem of the developmental mechanics of teeth and jaws ought to be attacked with a much wider range of weapons than those at present possessed by any one of us singly. The experimental embryological approach was brilliantly started

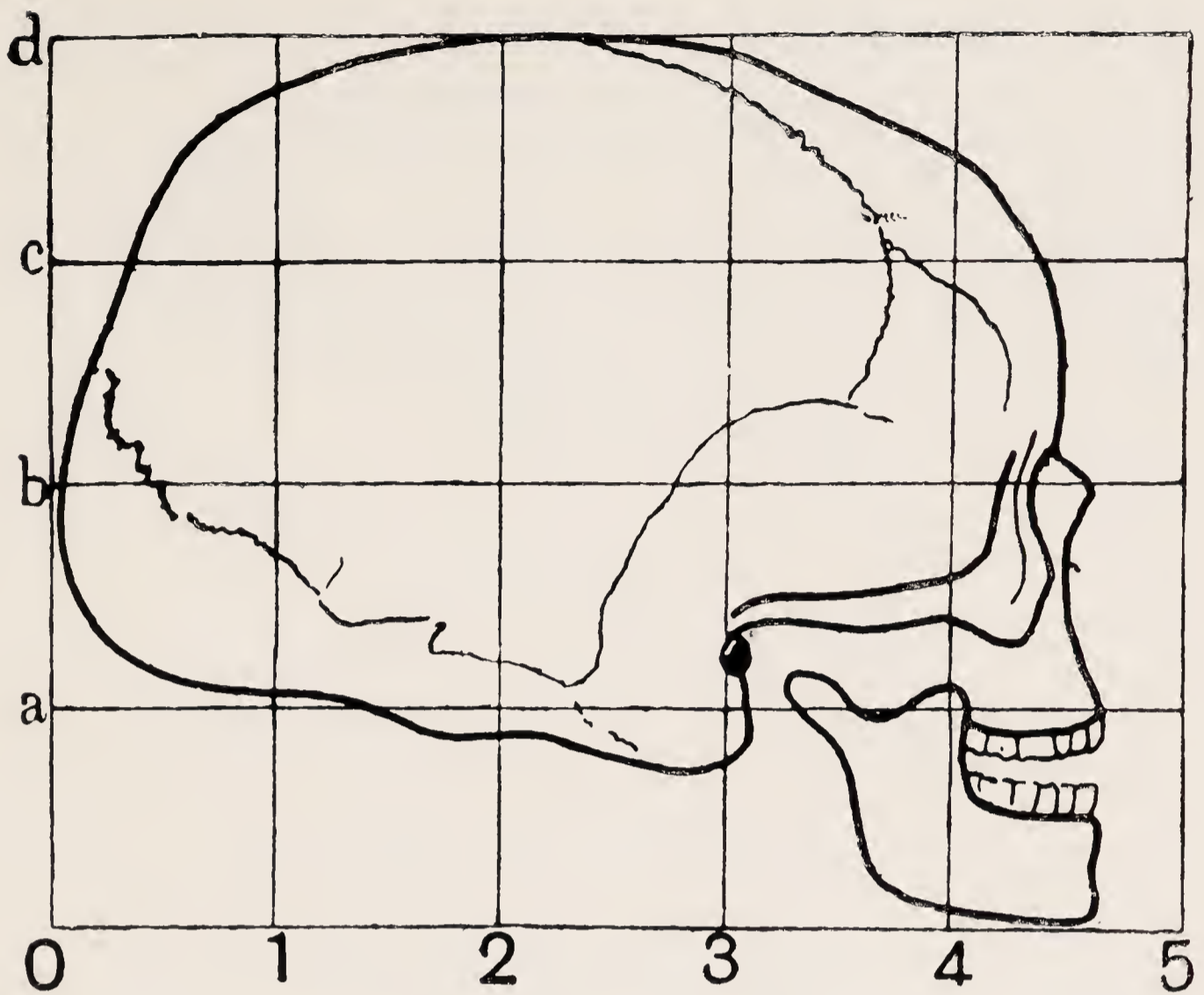


Fig. 9. Lateral view of human skull drawn in a simple system of Cartesian co-ordinates. (from Thompson, 1942)

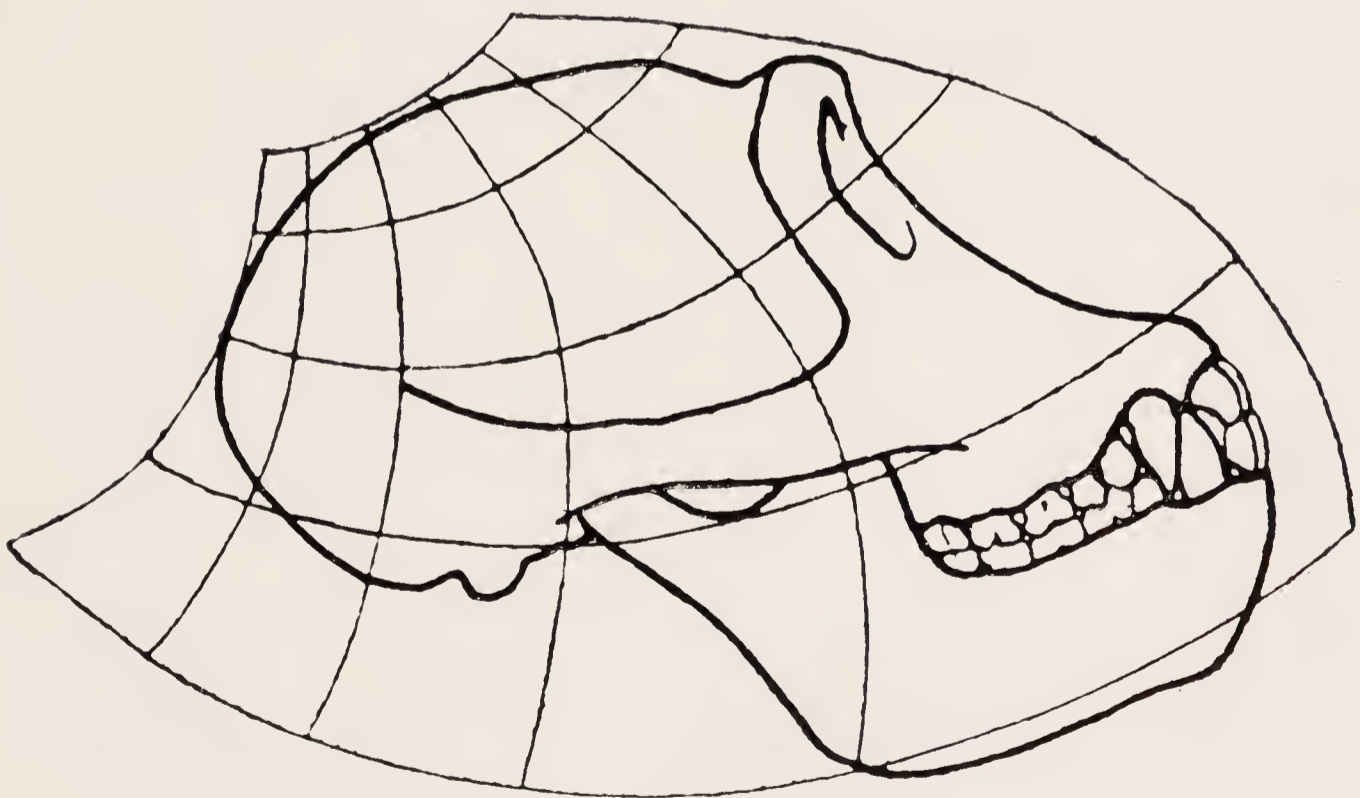


Fig. 10. Chimpanzee skull showing transformation of co-ordinates from fig. 9 (from Thompson, 1942).

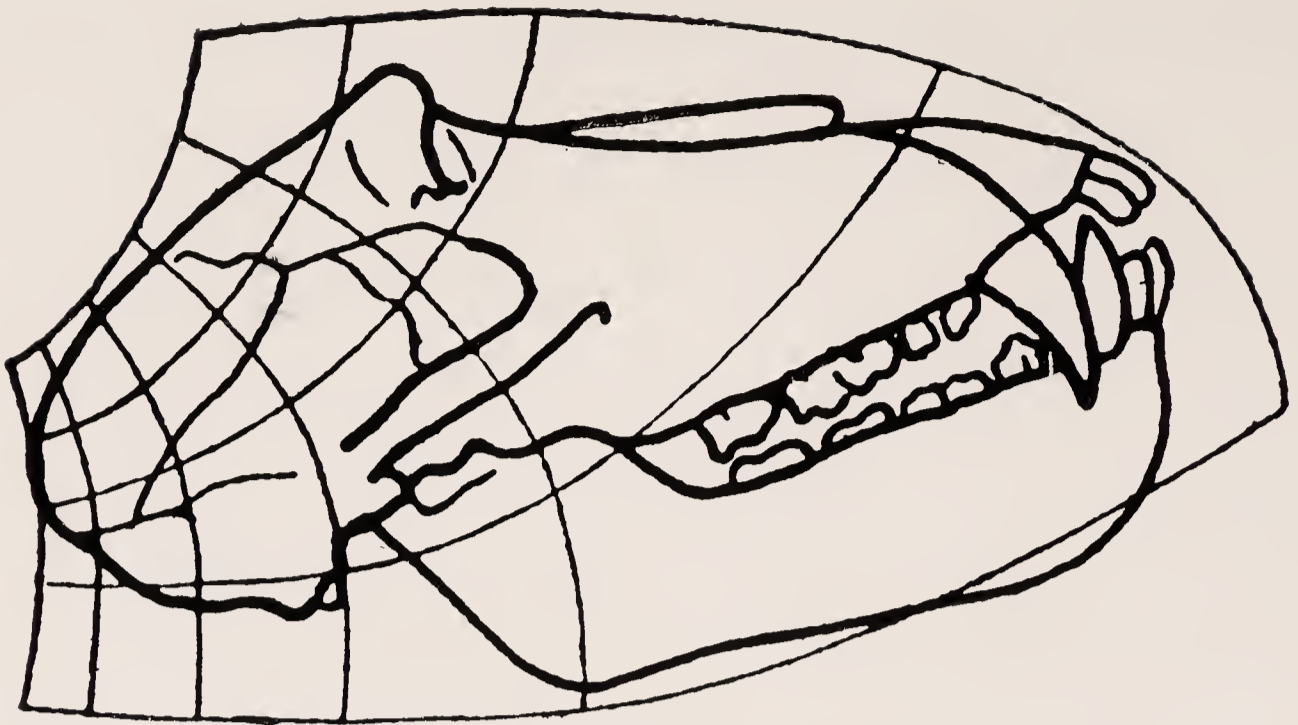


Fig. 11. Baboon skull showing transformation of co-ordination from fig. 10. (from Thompson, 1942).

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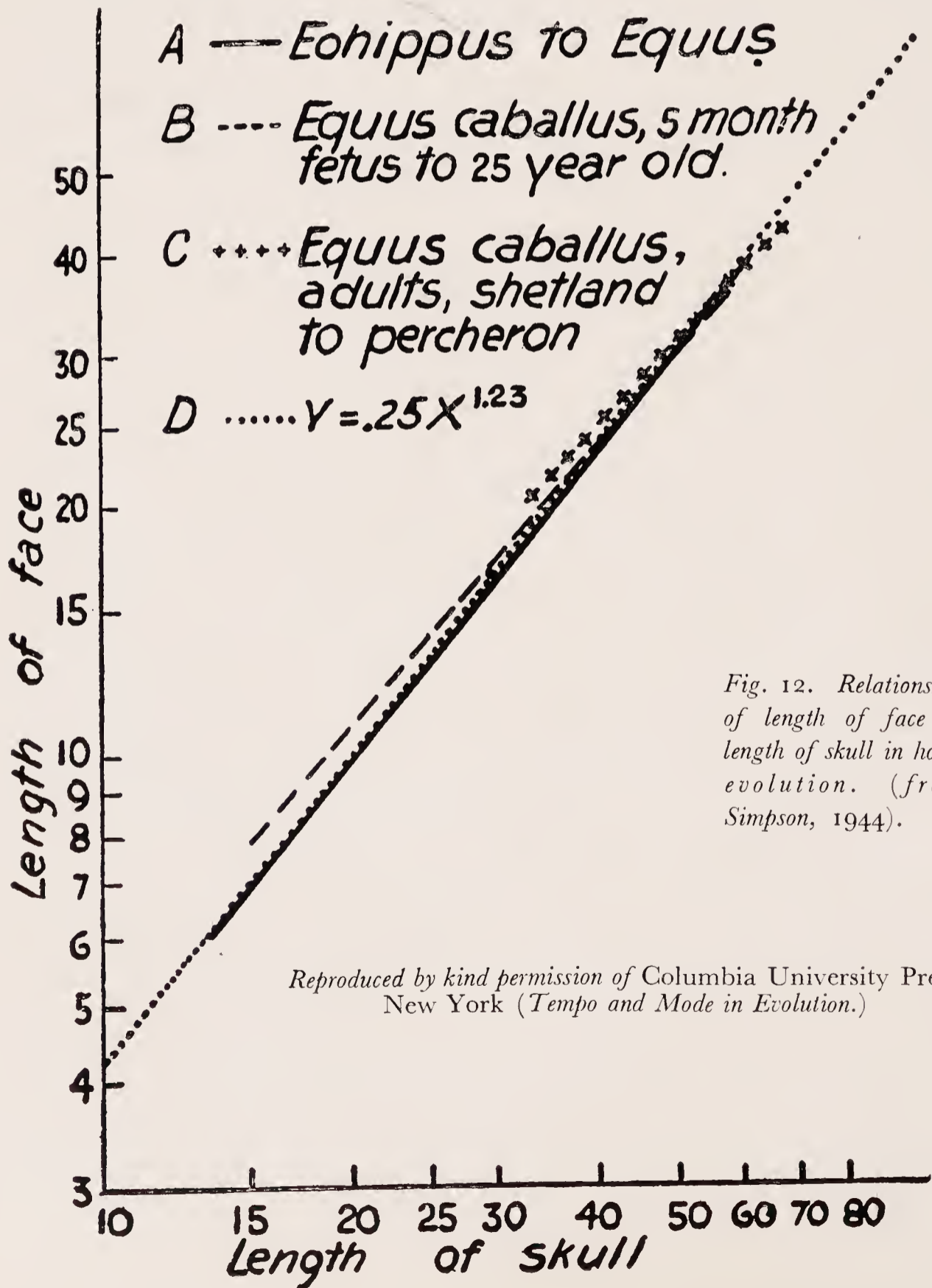


Fig. 12. Relationship of length of face to length of skull in horse evolution. (from Simpson, 1944).

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by one of your members some years ago, but unfortunately neither in this country nor elsewhere was it followed up. The culture of individual teeth *in vitro* ought to be extended. I was very much surprised to hear that there is no post-graduate school or department of orthodontics in this country. It seems to be rather astonishing that there should not be available this focus for research activity in a field which is obviously expanding day by day. With the wealth of enthusiasm for the subject which the very existence of this Society indicates, it is clear that some method whereby the research work on it can be canalised and stimulated is highly desirable.

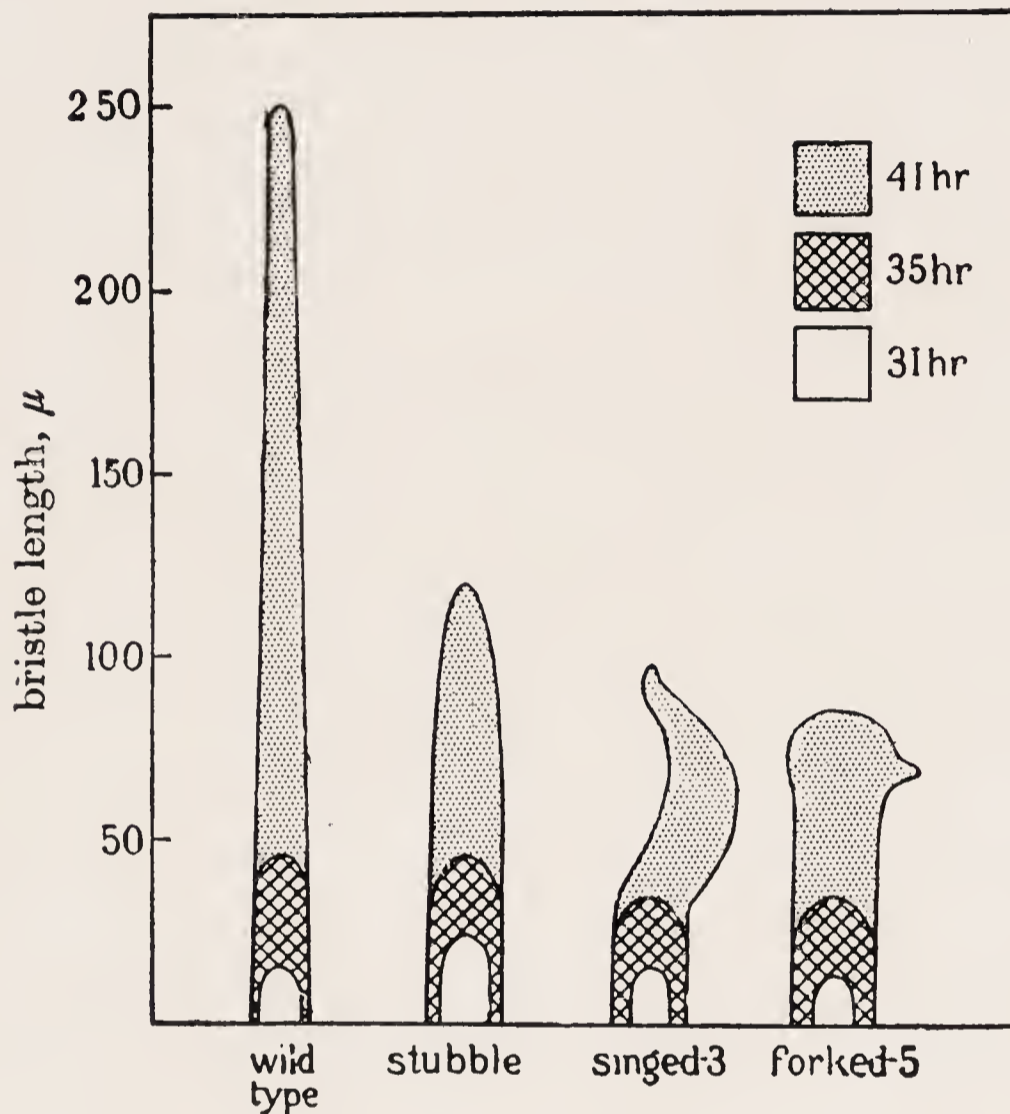


Fig. 13. Stages in the development of three different (inherited) mutations of the normal wild type bristle in *Drosophila*. Inharmonious growth of the sheath and its contents is clearly indicated in the mutants (from Lees & Picken, 1944).

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DISCUSSION

Mr. Stocker, in opening the discussion, said that Prof. Harris had stated that the independence of genetical control over the jaws and the teeth was to be expected because of their different phylogenetic and embryonic origin, and that this expectation was confirmed by the surprising lack of correlation between the size and structure of the jaw and that of the teeth borne upon it. He would like him to explain exactly why he would expect a *considerable* degree of independence. The teeth were, after all, of partly mesodermal origin, and the influence of the genetic factor on the size

of the jaws must surely be partly effective through the teeth. He meant that the size of the teeth being genetically determinable must have some effect on the size of the jaw. He did not see, therefore, how it was possible to talk of independent genetic control. The lack of correlation he mentioned was surely much better explained by the independent environmental control over the tissues. It was obvious that the environment could have little influence on the size of the teeth, but he would have thought it equally obvious that it might have a great effect on the size of the jaw. The environment was thus able to effect quite independent control in the two tissues, not because of their different origins, but because tooth enamel was a static rigid tissue laid down before it became functional, while bone was a plastic material. It seemed to him logical to deduce that the disproportion between the two tissues, almost universal in highly civilised communities, was due to the unnatural environment, since this civilised environment must affect the two tissues independently, while the genetic factors could not act quite independently.

When he spoke of the influence of the environment he was not supporting a Lamarckian view of heredity. He meant, of course, the influence of the individual. He believed—and in this belief he was in the company of Sim Wallace and of others much better qualified to judge than himself, that the smaller jaw, as Prof. Harris put it, was formed *de novo* in each generation. Prof. Harris appeared to dismiss this possibility or to regard it as not worth discussion. He would like him to tell them why. Extrinsic factors such as artificial mechanical forces he naturally only mentioned in passing. But what of such factors as the softness and concentrated form of civilised diet? The great difference between the amount of use open to the jaws of civilised people on the one hand and of primitive people on the other was apparent from the amount of attrition of the teeth. Surely this difference in the amount of use must also affect the density of the growing bone, and surely an erupting tooth would move easily either lingually or buccally rather than force a space for itself by a regular expansion of the arch, if the bone lingually and buccally was thin, through a sort of disuse hypoplasia.

Again, this discussion of the diminution of jaw size because of lack of selective pressure did not explain why tooth size had not decreased rapidly for the same reason. If it had, they would not find overcrowding as common as it was. Actually there was more room for tooth size to diminish than for jaw size because possession of small teeth—in women at all events—was an advantage, while overcrowding, due to a small jaw, as Prof. Harris had said, was a disadvantage. The horse mouth, considered typically English by foreign cartoonists, was not a help in the struggle for a mate, even if harmless in the struggle for existence. Sexual selection should have prevented its increase if evolution was the cause.

If it was accepted that evolution was the cause of the prevalence of irregular teeth, the possibility of preventing such irregularity was practically excluded. Eugenic measures would hardly be justified for such a non-lethal defect. On the other hand, treatment was difficult, expensive, and seldom quite satisfactory. Before reaching a conclusion surely they should explore thoroughly the possibility that the environment could be altered sufficiently to

mask the genetic differences which existed behind the few normal individuals and the many abnormal ones.

To take a not quite, but nearly, fair analogy, if they wanted to prevent tuberculosis they would concentrate, not on the genetics of the tuberculous diathesis, but on the elimination of the tubercle bacillus. If neither nature nor art could produce a race adapted to civilised diet, let them adapt their diet to the individual constitution. He could derive no satisfaction from the picture painted by Prof. Harris of future palaeontologists digging in the atomic or post-atomic strata and finding them teeming with fossilized orthodontists !

Mr. Ballard said that he thought a much broader view of this problem had to be taken by those engaged in research. The mention of random variation brought up a very important point. There was an inclination to regard the orthodontic problem as a sort of tooth and bone problem, but actually even more important than bone formation was the genetic form of muscle pattern and behaviour pattern of the tissues. These were just as much a part of inherited characteristics as bone pattern.

Mrs. Hughes said that Professor Harris had made some very useful suggestions for experimental observation. Some useful work in this field could be carried out by people in practice. The ordinary practitioner, whether he was an orthodontist or not, collected quite a large number of observations from the various families he attended—grandmother and children and so on—and from such observations a large number of genetical factors could be deduced. Professor Harris had also mentioned one or two examples of experimental work recently carried out. She had received lately from Sweden a reprint containing particulars of some work done there on amphibia, bearing to some extent on the formation of jaws and teeth.* She had not assimilated its details, but it seemed to her that work like that could be done in this country, and would furnish some idea of how genetical factors were responsible for tooth and jaw formation. They had to start at the embryological end. She felt that orthodontists should work in conjunction with embryologists and with geneticists.

Professor Harris had said something about transplantation of teeth. She had done a little work on that subject and knew how difficult it was. It was all very well talking about taking embryonic teeth and transplanting them to the adult jaw, but it had to be remembered that these embryonic teeth would not grow in septic areas, and it was difficult to transplant a tooth into an ordinary mouth teeming with bacteria. One experiment had been carried out but was not sufficiently convincing. She thought, nevertheless, that it could be done, given the right opportunity and the right conditions. All this required a team of workers, and it was to be hoped that a number of people who had had dental training would enter research.

One interesting point was the transplantation of tooth germs at different stages of development. She had found that if molar tooth germs were transplanted at an early stage they would not form cusps, but at a later stage they would form cusps ; also that if these tooth germs were taken at an early stage and cut in halves before cusps were formed the two halves would form two little perfect teeth.

* *The work of Sellman (1946) to which Mrs. Hughes refers, was not known to me when this lecture was given. It is a most important contribution to the subject, and deserves to be widely known.*—(J.H.)

One other point concerned the supposedly inert nature of enamel. But enamel was not as inert as it was supposed to be, as was shown in some recent work done with radio-active phosphorus. When animals and human beings were injected with radio-active phosphorus, this did appear in the enamel.

Once again she wished to thank Professor Harris for his stimulating lecture, and to express the hope that he would undertake new forms of research.

Dr. Grüneberg apologised for speaking to an audience of orthodontists without any knowledge of their subject himself. He wanted, in the first place, to endorse one point made by Prof. Harris concerning random variations—variations which could not be ascribed to genetical factors nor, on the other hand, to tangible environmental conditions, since they just happened in the same random fashion as the fall of a penny, when it was determined by a number of physical causes whether the penny would come down head or tail. On the other hand, he had some doubts whether the attempts to deduce genetic actions from the transformation of co-ordinates according to D'A. Thompson was a legitimate procedure. He thought that the only way in which the action of the genes could be found out was by direct experiment. If a simple transformation of co-ordinates gave the desired effect, this might be done by a single gene, but every geneticist knew that it was vastly more complicated. The genes could be demonstrated only by direct experiments and not by mathematical transformations.

He wished to utter a word of warning against some of the attempts to explain by deductions from population genetics the genetic ratios for mal-occlusions which had not yet been analyzed into the influences of genes. It was true that in dogs certain types of mal-occlusions were due to simple gene variations. On the other hand, whether similar conditions in man were due to similar genetic substitutions was doubtful, and until this was known it might be advisable to be very careful in making assumptions.

He wanted to draw attention to certain types of material which could be used with great advantage for the solution of orthodontic problems. There had been published in journals not generally read by orthodontists the fact that there existed a number of inherited conditions which led to retention of teeth. If something could be learned about the mechanisms which led to retention of teeth it might be possible to learn something more about orthodontic abnormalities. In the mouse there was one gene in which there was no secondary bone absorption, and experiments had been recently described in the mouse in which a very serious reduction in bone absorption had been observed. A similar phenomenon had been observed in the rat—a mild abnormality in bone absorption. If these things were studied in a series it might lead to a closer knowledge of those factors which caused abnormal or retention of teeth in humans due to abnormalities of bone absorption.

Mr. Hallett said that he had had Professor Harris's paper in his hands for only a few hours, and neither his zoological nor his mathematical knowledge was equal to the occasion, so that he had been very glad to be there that evening and to feel that Professor Harris had qualified materially what he had written. There was one point about which he desired to ask him. How was it, when

the tail organiser apparently was presiding, and not the head organiser, they got teeth in the ovarian cysts—quite good teeth formed in that position?

In his own humble way he had tried to follow the precept of their illustrious founder, and to take models of his own children's teeth regularly from an early age, and he had also tried to do what he could in encouraging students at Newcastle to follow this example, because, after all, the dental profession was a normal cross-section of the community. He was collecting all the models he could, and there was a great deal to be learned from variations in pattern. In his own children he had observed a Class 2, Division 2, tendency, which was inherited, he would say, by them, but he was very gratified to find, especially when one considered what might happen with random variations, that otherwise they were perfectly normal children.

Professor Rushton said that the Society was really not in a position to discuss this paper. He could only say how much he admired it. He thought that what they all very much needed was occasionally to have someone from other realms of science who could put in simple words things too hard for them to study for themselves. He desired to say, partly stimulated thereto by Dr. Grüneberg's last remark, that he was very glad to hear Prof. Harris press so strongly the necessity of experimental work on indigenous teeth. That was one of the things they most strongly needed, and the other was the genetic analysis of abnormalities. The difficulty was to get people who were willing to devote their time and energy to this work of research. Dental research had been regarded as a dead end, because there was nothing further to which the researches could expect to proceed. He thought that those inclined to research could now be assured that the position was very much improved, and it should be known as far as possible that there were several bodies which were interested in supporting research in dental science, and that young men could enter this field with considerably more hope that they would be able to go on with it and make a career. When the men were available he was sure the opportunity would be forthcoming, but of the necessity for work in that direction there could be no doubt whatever.

Professor Harris spoke briefly on some of the points raised in the discussion but has incorporated his remarks in the following written reply.

Mr. Stocker's surprise at the suggestion of a considerable degree of independence between size of jaws and size of teeth will probably not be shared by geneticists. A certain degree of correlation might be expected if the genes responsible control endocrine or general nutritional factors, but in insects such as *Drosophila* the sizes of the bristles of the wings and of the body are independently varied to an enormous extent by genetic factors. Nevertheless the influence of environmental factors on the jaws may be expected to be greater than that on the teeth, as Mr. Stocker suggests. It is however interesting to read of a case such as that quoted by A. J. Wright (1922) in which in spite of a complete choanal atresia, the jaw form was not seriously affected.

Mr. Ballard's reminder that genetic factors may affect the jaw musculature and through it the form of the jaws, is a timely one. It would be a great advantage if the evolutionary mechanics of

the jaw musculature could be worked out in the same way as is now being attempted for the limb muscles.

The contributions by Mrs. Hughes and by Dr. Grüneberg were most welcome, representing as they did, authoritative opinions by specialists in two of the fields with which the lecture was concerned. Mrs. Hughes' reference to the work of Horstadius (1945) was particularly appropriate; this concerned the embryonic organiser pattern of tooth formation. An account of this work in English is in preparation. As a pioneer in the same field in this country, Mrs. Hughes had shown how valuable the tissue-culture method could be in analysing the pattern of tooth development; her comments on tooth germ transplantation and on the dynamic equilibrium of phosphorus in enamel provided further instances of the value of an approach through fundamental investigations.

Dr. Grüneberg's endorsement of the possibility of truly random variations was most welcome; his analogy with the tossing of a penny is a particularly satisfying one since it illustrates very effectively the importance of the time factor at the moment of impact of the penny on the floor—a case which parallels rather strikingly the possibility of occlusal variations brought about by small differences in time of eruption and contact, etc.

In suggesting that the Thompson system of co-ordinate transformations should be applied in orthodontic studies, I had no intention of minimising the importance of direct analysis of artificial or natural genetic experiments. Such experiments must always form the ultimate test, if not indeed the starting point, of all genetical analysis. The fact remains that an almost infinite number of variables, as well as an infinite range of values for each single variable, is involved in a full description of the detailed relationship between any pair of jaws. The difficulty is therefore to choose what is the characteristic for which the hereditary mechanism is to be investigated and it is in this field that the study of co-ordinate transformations might find its most profitable application.

Dr. Grüneberg's criticism of the application of population genetics to malocclusion statistics is of course a justifiable one. My lecture emphasised that the simplest possible case was chosen only as an illustration. Yet it is striking that even this over-simplified assumption has never been tested in practice, and if class 2 division 1 malocclusions are even *largely* governed by a single factor, such an analysis would prove highly suggestive. If class 3 malocclusions behave as an almost straightforward single dominant factor, why should we assume, *merely* because they occur so much more frequently, that class 2 division 1 types are necessarily so much more complex.

The scientific journals quoted by Dr. Grüneberg are a valuable source of information on fields closely related to that of orthodontics—fields in which he himself has made many notable contributions.

The formation of teeth in ovarian cysts, mentioned by Mr. Hallett, was at first sight surprising, but was probably no more than an imitation by nature of experiments which were now the stock-in-trade of the experimental embryologist. By transplanting a suitable combination of tissues, comprising the organiser and its simple or complex reacting tissue at an appropriately competent

stage, Horstadius has grown jaws, teeth and even gill slits in the intestinal region of the amphibian. One must therefore assume that owing to some teratological process the same thing had occurred in the natural manifestation of teeth in abnormal places ; the head organiser etc., were in part displaced to these foreign sites, and followed their normal course of development there.

It was a most welcome rounding-off of the discussion to have Professor Rushton's views on the possibilities of and openings for dental research. There is no-one better qualified to speak on this topic than he is, and if the problems and the financial support exist, it is much to be hoped that the research workers will soon be forthcoming.



THE UPPER RESPIRATORY MUSCULATURE AND ORTHODONTICS

Part I.

C. F. BALLARD,
L.C.R.P. (Lond.), M.R.C.S., L.D.S. (Eng.)

Since Mr. Gwynne-Evans and I first visualised this Paper, our observations and investigations have led us to a search for the origin of muscle posture and behaviour. As this subject appears to me to be one of the fundamental factors in future Orthodontic research with important bearings on etiology, diagnosis and treatment, I make no apology for cutting short my Orthodontic part of this conjoint Paper to leave most of the time to Mr. Gwynne-Evans. Very briefly, I wish to give you my views on the orthodontic reasons for this very necessary investigation into the origin of muscle posture and behaviour.

Firstly, in my conception of the positioning of the teeth in the oral cavity, the factors can be resolved into four groups ; they are as follows :—

1. The skeletal pattern.
2. The muscle pattern.
3. Dento-alveolar factors.
4. Occlusal forces.

The skeletal pattern is genetically determined and cannot be altered by orthodontic treatment ; this may be a rather dogmatic statement but I have never convinced myself that, in any of my treatments, I have succeeded in producing a change, and Brodie and others in their investigations rather confirm that view. Brash says “ . . . in general, if we are to arrive at any useful conclusion as to the part played by inheritance in the etiology of irregularities and mal-occlusion of the teeth, we require not merely pedigrees of individual varieties of these conditions but rather a detailed analysis of the mode of inheritance of form and size of jaw.” Again he says “ . . . it appears that at the back of all this discussion about the lack of the use of the jaws is the erroneous assumption that growth and size of bone must be in some direct ratio to the magnitude of the forces applied to them and the frequency of that application ; whereas it is more probably that there is a very wide range of activity within which growth will proceed in a perfectly normal manner, and that it requires an altogether exceptional degree of lack of use amounting almost to cessation of use altogether to affect in any degree the growth of the bone concerned. No amount of exercise on the other hand can possibly induce any part of the skeleton to grow beyond the limits to which it is congenitally pre-determined.”

All the literature discussing factors governing bone growth usually come to the general conclusion that, although evidence is inconclusive, the main factors are probably hereditary.

What I have said so far applies to the basal bone of the maxilla and mandible. The alveolar bone and teeth are built up on these bones from the dental base, I believe that the relationship of these

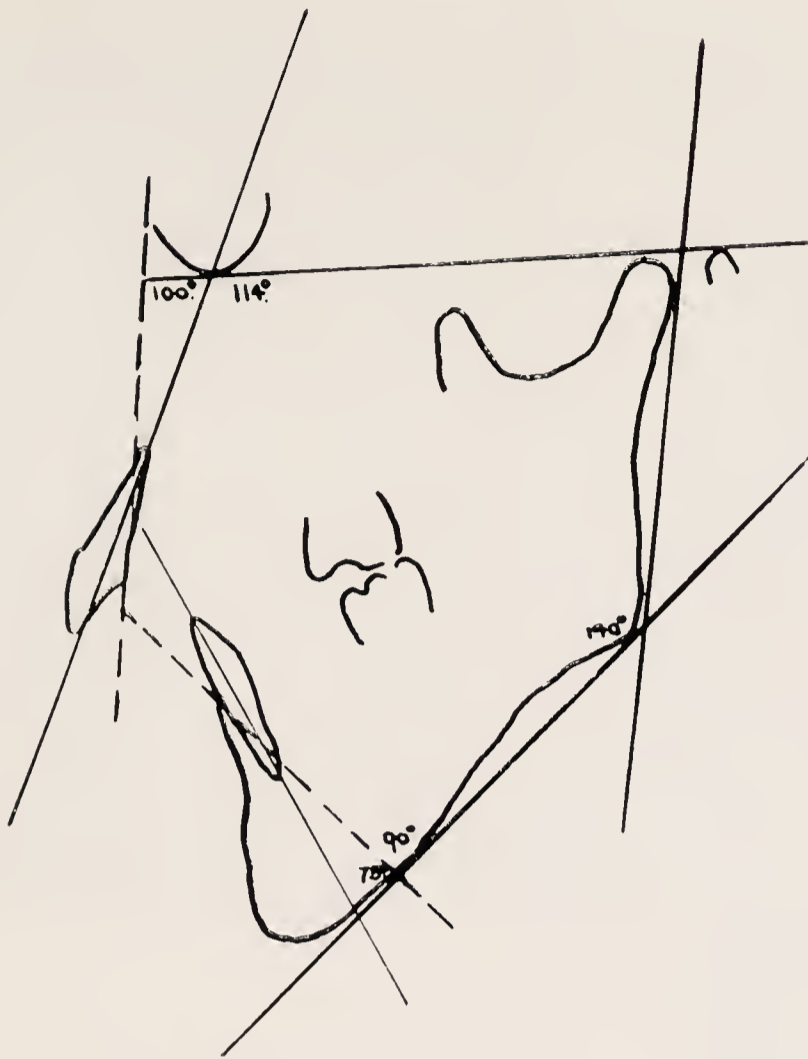


Fig. 1. Lateral tracing from the X-ray of a boy with Class II div. I (Angle) occlusal abnormality.

dento-alveolar structures to the basal bone is also intrinsically determined. The position of alveolar bone as built up on these dental bases is further determined by the position of the crowns of the teeth as they lie in equilibrium within muscle forces. Therefore, there is no intrinsic growth factor in alveolar bone but its shape and position determined by the two factors just mentioned ; firstly, the intrinsically determined relationship of the dento-alveolar structure to basal bone, and secondly, the position of equilibrium within muscle forces which the crowns of the teeth assume as they erupt.

We can now consider the second group of factors which determine the position of the teeth within the oral cavity ; that is, the position of equilibrium which the teeth assume, normal or abnormal, within the muscle forces. When we realise what slight pressure applied to the crown of a tooth will produce a physiological response in alveolar bone, I think we must admit that, in all our orthodontic cases, we have to regard the teeth as we see them, normal or abnormal, as being in this position of equilibrium.

I am using these slides just to illustrate and not prove my argument. I hope to have an opportunity to do that in a future paper. Fig. 1 shows a lateral tracing of what is probably a fairly typical Class 2, Division 1, case. Now in my view, because we cannot alter the relationship of mandibular basal bone to maxillary basal bone, and because we cannot alter the position of the dental bases on either of these bones, then successful treatment in such cases is accomplished by altering the axial inclinations of the incisor teeth to bring the crowns into correct anatomical relationship. I have marked the changes of angles required and they conform to the normals which have been worked out by various people.



Fig. 2 & 3. Identical twins with the typical anterior oral musculature associated with Class II div. I (Angle) incisor relationship.





Fig. 4. The mother of the twins with similar anterior oral musculature.

If the buccal segments are in continuous contact-point relationship with these abnormally inclined incisors, as they usually are, then they similarly require mesial or distal movement to produce normal occlusion ; this is what actually happens in most successfully treated Class 2, Division 1, cases. The small percentage of complete failures are probably the result of the skeletal pattern being so abnormal and unalterable, that it is impossible to produce normal occlusion by this change of axial inclination.

In Figs. II and III the facial musculature of these twins is typical of that which produces the Class 1, Division 1 (Angle) dento-alveolar abnormality. It is an inherited posture. Posture may be defined as a held attitude ; and Wright says "Posture is the basis of movement and all movement begins and ends in posture."

Now, important points are these. If the crowns of the teeth were in equilibrium in muscle forces and if the relationship of basal bone was not the cause of the abnormality, then this must have been produced by the said muscle forces. Further, if the abnormality is inherited, and very few people will doubt that these days, then the muscle abnormality must be inherited, and that is my contention.

If then, as I believe, a very large number of the abnormalities we see are the result of abnormal muscle action, we must commence serious study of the genetics of muscle behaviour ; we must attempt to determine what are inherited characters of behaviour, what are acquired, what are alterable and what are not.

The work of Gesell and Stockard, and my own observations, leave no doubt in my mind that postural patterns and patterns of behaviour of the musculature are intrinsic in origin—genetically determined. Gesell said “. . . whether we are concerned with bones or behaviour, the fundamental determiners of form are intrinsic, endogenous rather than exogenous. So-called environment does not generate the progressions of development. Environmental factors support, inflect and specify, but they do not engender the basic form and sequences of ontogenesis.” And later, he says “. . . this principle of maturation certainly applies to the physical morphology of the mouth and to the movements of the mouth.” Stockard did some extensive work on the cross-breeding of dogs and he came to the following conclusion. “Certain genes were shown to have a specific influence on the morphology of bone and even on the morphology of the dog’s behaviour.”

My third and fourth factors in the positioning of the teeth do not enter into the discussion tonight because they only produce local changes of tooth position and not important changes of arch form within muscle forces or changes of skeletal pattern.

Originally Mr. Gwynne-Evans began his work in an attempt to elucidate the disorders of muscle behaviour in relation to mouth-breathing and thumb-sucking. He in his paper is going to elaborate this idea of the intrinsic origin of muscle behaviour. He will also deal with some of the principles of treatment. However, I should like very briefly to give you what I think are the basic principles of treatment from the orthodontic point of view. It will be readily realized that as we believe all muscle behaviour patterns are central nervous in origin, the treatment must be through the central nervous system. Children under the age of about fourteen years are not capable of applying prolonged conscious effort to the correction of abnormal posture and therefore, they must be treated through subconscious levels and for this we use a Monobloc appliance. Mr. Gwynne-Evans will explain the rationale of this. If the abnormal muscle action has produced an abnormal dento-alveolar position, then this must be corrected prior to the use of the Monobloc appliance, otherwise it will reverse the good done during the period of re-education, that is, when the appliance is worn at night, etc.

If the patient is about fourteen years of age, or perhaps it would be better to say when he or she is reaching the stage of muscle and mental maturity, then a conscious effort on the part of the patient will usually produce the required change in muscle pattern. This is particularly the case when, for instance, a girl who has just been treated for a Class 2, Division 1, abnormality becomes conscious of her appearance and realises that she looks much better with her lips together. If this orthodontic treatment had been completed say three years earlier, then the required conscious effort would not have been obtained and we should have had to retain our orthodontic treatment with a Monobloc appliance which would at the same time have helped the re-education of the musculature.

Just as some cases may be complete failures because of the skeletal pattern not being alterable, so some are untreatable because the muscle pattern is unalterable.

I will now leave you to Mr. Gwynne-Evans whose paper and film, I believe, are going to give us a most valuable lead in the

investigation of muscle abnormality, and having heard his point of view, you will realise how closely related are the fields of Rhinology, Speech therapy and Orthodontics.

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Part II.

E. GWYNNE-EVANS, M.B., B.S. (London)

From my point of view, by far the majority of young children referred to Ear, Nose and Throat Clinics for "Tonsils and Adenoids" are suffering from the effects of a variety of functional disturbances involving the feeding, breathing and speech mechanisms which, in themselves, are not so much due to abnormal behaviour of the musculature, as due to the presistence of infantile characteristics.

Although in time the tonsils and adenoids may be removed, these functional disturbances tend to remain until the child is said "to have grown out of them." By then, however, their ill effects may have become permanent.

Ultimately will come this question—what alternative form of service can we offer? I believe that a closer association between the fields of Child-welfare, Rhinology, Orthodontics and Speech Therapy will provide the answer.

In 1945, Mr. Capps summarized the aims of an experimental composite consultative clinic in the Proceedings of the Royal Society of Medicine and an attempt was made to interpret the clinical picture of the so-called mouth-breather.

We consider that the most serious cause of functional disturbance among the facial muscles was loss of "tone" secondary to any number of contributory factors, both of neurogenic and environmental origin. The phenomenon of tonus is difficult to comprehend but in effect, a few muscle fibres are contracting at one time, relaxing, and as many others are contracting at the next instant in a rhythmical cycle of activity and rest. Being reciprocal in its mode of working, opposing groups of muscles are evenly balanced one with the other when at rest, movements are correlated and smooth effortless action is largely secured. The acquirement of this property of neuromuscular activity among the skeletal muscles distinguishes the infant from the foetus and becomes apparent first in those muscles concerned in postural balance. Eventually, a background of tonus pervades all our voluntary musculature, but often appears late among the shoulder and jaw muscles, so that winged scapulæ and a dropped mandible are common features in childhood.

We believed that disturbances were only partial and did not affect all the functions of a particular group of muscles, but as the function of any muscle depended on the evolutionary history of that muscle, the last of the functions to be acquired on the evolutionary scale would be the first affected. This hypothesis was not entirely satisfactory but served to explain the frequency of certain defective speech sounds and the impassiveness of the muscles of facial expression, whilst the breathing and feeding mechanisms themselves remained undisturbed.

At that time, our Orthodontist, Mr. Nove, was of the opinion that mal-related jaws produced a state of imbalance between the muscles and he used the Andresen appliance as an intra-oral splint to obtain an optimum relationship between the jaws and so restore facial harmony.

I agreed that in some cases, failure of the orbicularis oris to keep the lips closed, was due to a state of imbalance among the facial muscles secondary to a mal-relationship between the jaws, but when we came to consider the origin of disturbances in muscle function related to the breathing and feeding mechanisms, we found that our views were divergent.

First Series



I. *Infantile facial pattern of baby aged 4 months.*



II. *Persistent infantile facial pattern in brothers aged 3 and 7 years.*



IIIa



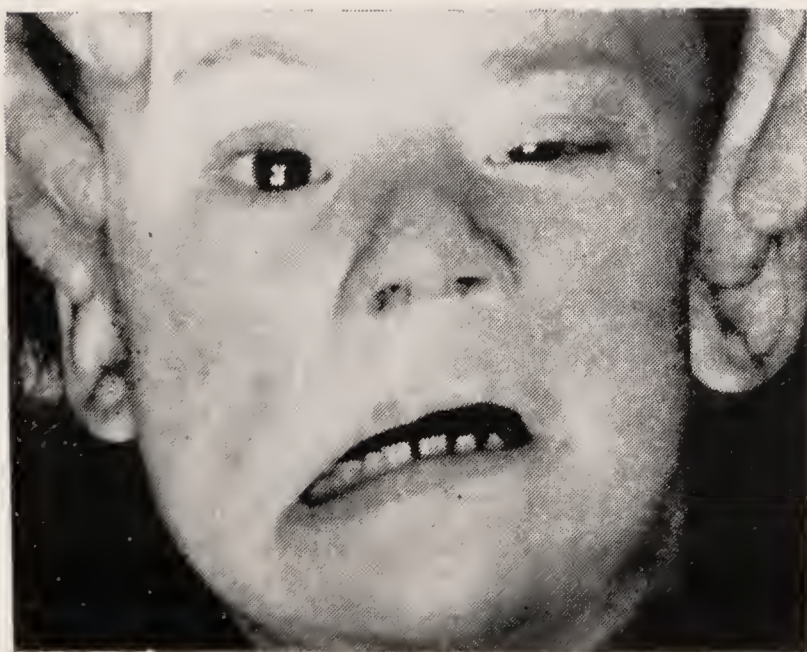
IIIb



IV



V



VI

III. a & b.

Persistent infantile facial pattern, with thumb-sucking habit in child aged 3½ years.

IV. *Mature facial pattern with hand to mouth habit in child aged 4½ years.*

V. *Mature facial pattern with no residual infantile characteristics in child aged 6 years.*

VI. *Disorganized facial pattern due to cortical release phenomena in mentally deficient child aged 10 years.*

In 1946, Nove published his concept of Cervico-facial Orthopædics which starts from the fact that the functional efficiency of the entire group of cervico-facial muscles is associated with a normal cranio-mandibular relationship.

Whilst he laid stress on skeletal deformities as causative factors underlying functional disturbances of the breathing and feeding mechanisms, my attention was being drawn more and more to the significance of underlying principles of neuro-muscular activity. I consider that motor behaviour of muscles although modified by environmental factors, was planned within the central nervous system long before birth ; that "tonus" was the basis of muscle balance and was essentially of neurogenic origin ; that reserves of tonus among the voluntary muscles, although subject to environmental conditions, were gradually acquired and built up as the central nervous system matured and groups of muscles were progressively selected, co-ordinated and controlled.

I agreed that the teeth, jaws and cervico-facial muscles constituted a functional unit, but I could not lose sight of the fact that it was the central nervous system that made them so.

I was of the opinion that muscle behaviour was pre-determined, patterned and dominated by the central nervous system whatever the relationship between the jaws might be. So it came about that I decided to investigate our problems further, by enquiring into the manner in which the central nervous system was planned and organized to react to environmental conditions.

I have found encouragement during the last twelve months in being invited to attend some of your meetings and in conversing with people outside my usual circle of hospital activities. I refer particularly to Dr. Whillis and Mr. Rix. A short time ago Dr. Whillis described and showed us on a film, the behaviour of the oro-facial musculature in drinking and swallowing. Previously, Mr. Rix had demonstrated to us also through the medium of a film, the persistence of the infantile pattern of behaviour in swallowing among certain children.

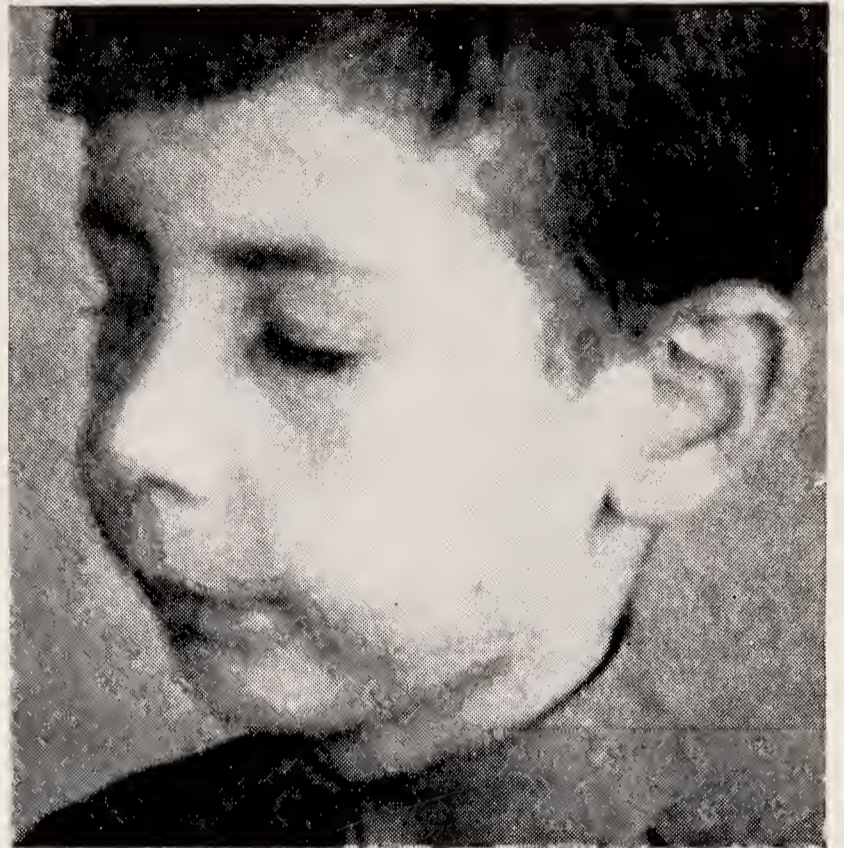
Both these workers have stressed the importance of functional closure of the inter-maxillary space in swallowing. As, in nasal breathing, I am also concerned in the functional closure of the inter-maxillary space, although only as far as the teeth are held together intermittently in light occlusion, for personal reasons, if for no other, I am grateful to you Sir, for your invitation to speak here this evening.

We have three film strips to show you. In filming, particular care has been taken to register the natural behaviour of the child. The first strip of film illustrates normal and abnormal behaviour patterns of the facial musculature. The children appear in the order of a descending gradient—i.e., we start with a child well versed in muscle control ; then we come to two children exhibiting infantile characteristics, and finally, to two children whose musculature has not become properly organized owing to states of mental deficiency.

1. The clinical picture of the first child is akin to the adult pattern and reflects an active, happy, intelligent interest in his surroundings.



Ia



IIa



Ib



IIb

Second Series

I a & b. *Mature facial pattern with teeth together on swallowing in child aged 10 years.*

II a & b. *Immature facial pattern with teeth apart on swallowing in child aged 8 years.*

2. The second child has not quite reached a comparable stage of maturity and a persistent hand to mouth reaction is a feature of the clinical picture.

3. The facial appearances of the third child resemble those of an infantile, rather than an adult pattern. The musculature lacks tone and the facial expression is characteristically impassive. He is an habitual mouth-breather and thumb-sucker. He has obstructive adenoids and a close up view shows the position of the thumb in relation to the teeth.

4. The facial expression of the next child is not only impassive, but even more reminiscent of the infantile countenance. The mouth is open and he is a persistent "mouth-breather" in spite of the fact that when the sucking pattern of muscle behaviour is restored by sucking his thumb, he is able to breathe comfortably through the nose.

These children exhibit functional disturbances in the organization of neuro-muscular behaviour.

The last two children exhibit disturbances of organic origin.

5. The first child is a mongol; the oro-facial musculature is active but inco-ordinated.

6. The second child is mentally deficient; the facial pattern is totally disorganised and demonstrates the consequences of cortical release.

I think these pictures are sufficiently clear to show the purpose of our enquiry into the organization of the nervous system.

Our field of investigation is so vast and possible lines of approach are so many that I think it is important for us to spend the next few minutes in reviewing the child as a whole, so that we may get some idea of perspective.

Generally, it may be said that pre-natal development recapitulates the evolution of the species and in the first period of life, the evolution of primitive man. The major part of development has been completed within eight to ten months so that even if premature birth occurs, growth is so far advanced that the infant may yet survive. But of all the species, man has the longest period of immaturity.

For us, the word "mature" has become a key word and is used in the dictionary sense that growth processes are "brought to completion, as a scheme" (New Gresham English Dictionary). As far as the neuromuscular system is concerned, we mean by "maturation" that the supervisory machinery of the brain is working according to a plan and that groups of muscles are progressively selected, co-ordinated and controlled for the service of the child's future activities in the world that awaits him. Concurrently, infantile characteristics of muscle behaviour are being inhibited and in time, will be lost.

Soon after the foetal stage has commenced, then neuro-muscular system shows signs of organization and it is during this early period that the central nervous system begins to "pattern" muscle behaviour. When the time comes for using the developing tactile and muscle senses as well as those of the eyes and ears, the central nervous system plays a leading part in building up specific movements out of the basic patterns of muscle behaviour.

From the moment of birth, the infant explores the physical and social world with its muscles. Arms, legs, hands, feet, mouth, lips,

tongue and palate—all are involved. One of the earliest reactions to environment is the infant cry which in itself is an emotional expression that involves a total reflex response of the facial musculature without special expressive movements of the tongue or lips. As the organization of the nervous system advances, the facial muscles become more versatile. The respiratory and sucking muscle patterns are combined with the voice stream so that the previously undifferentiated cry is transformed into gurgling and babbling. In response to contacts with the social world, he indulges in sound play which delights both himself and his admiring parents.

At the same time, the muscles of the eyes are co-ordinated and controlled so that vision can be linked with movements of the arms and hands. Objects are inspected, grasped and brought to the mouth. "Mouthing" is one of the ways a child discovers his surroundings; eyes, arms, hands, mouth and feet share in the process. All these reactions are instinctive and reflex in nature. He is just as happy with a spoon as with a rattle and he may just as soon suck his big toe as his thumb; but, behind all this pantomime lies a purpose—that of co-ordinating and controlling his muscle activities until in time they become obedient to the developing mind. By slow degrees he learns to chew and initiate the act of swallowing, to sit by himself, crawl and stand. Once he can stand without support, his hands are freed to make new conquests. The hand to mouth reaction however persists for some time and he is inclined to put objects in his mouth or suck his thumb until about five years of age or later.

In the same way that the eyes guide the muscles of the arms and hands in the execution of finer movements, so a parallel growth of intelligence and understanding enables the child to link his auditory sense with movements of the oro-facial muscles involved in sound play. By imitating and echoing the "baby talk" of his mother, the muscle patterns of sound play are re-shaped into speech patterns which eventually come to have meaning so that words and finally, sentences are formed.

Meanwhile, the muscles of facial expression reflect his pleasures and his fears. He smiles and laughs, or whimpers and cries, but as the processes of growing up proceed, emotional reactions are inhibited in favour of his more intellectual capabilities and the facial expression takes on the maturer characteristics of the individual.

However, until the central nervous system is sufficiently mature to maintain an adequate degree of co-ordination and control of the facial muscles at rest, they tend to remain flaccid and after the first few months of life, the lips more often than not, remain apart.

With regard to the underlying machinery of all this activity, the combination of inborn reactions might be compared with the engineer's "blue prints" and the subsequent patterns of motor behaviour, the designer's "jigs" or "dies" that have been gradually fashioned throughout the ages and successively make their appearance to allow the outgrowth of more complex patterns of movement.

For example, as an outgrowth from the attitudinal reflex actions, come not only the ability to stand and walk, but such specific movements as may be seen in building a tower of bricks or in the use of a knife and fork. Similarly, out of the sucking behaviour



(a)



(b)



(c)

Third Series

*Changing facial patterns
in same child at different
times, when*

- a. maturer characteristics
predominate.*
 - b. facial muscles are not
utilised.*
 - c. sucking response recurs.*
-

pattern will grow not only the processes of chewing but highly complex movements concerned in speech.

Our reactions to environment are not just the result of miscellaneous pin-pricks. As any blind man will tell us, we are living in a world of patterned stimuli. By means of receptors in the skin, muscles, tendons or joints, as well as those in the retina and cochlea, patterned impulses are transmitted through sensory pathways parallel with those of the executive system to the higher centres in the brain.

J. Z. Young in a recent article on the functions of the central nervous system summarizes hypotheses that conceive " . . . the cerebral tissue as a matrix, within which various patterns of activity can be set up by the sensory situations which the organism meets during life . . . We can imagine the initial condition of the system in the newly-born animal (or earlier) either as at rest or having some innate pattern of activities of its own, which determines from the start what sort of sensory patterns will be reacted to."

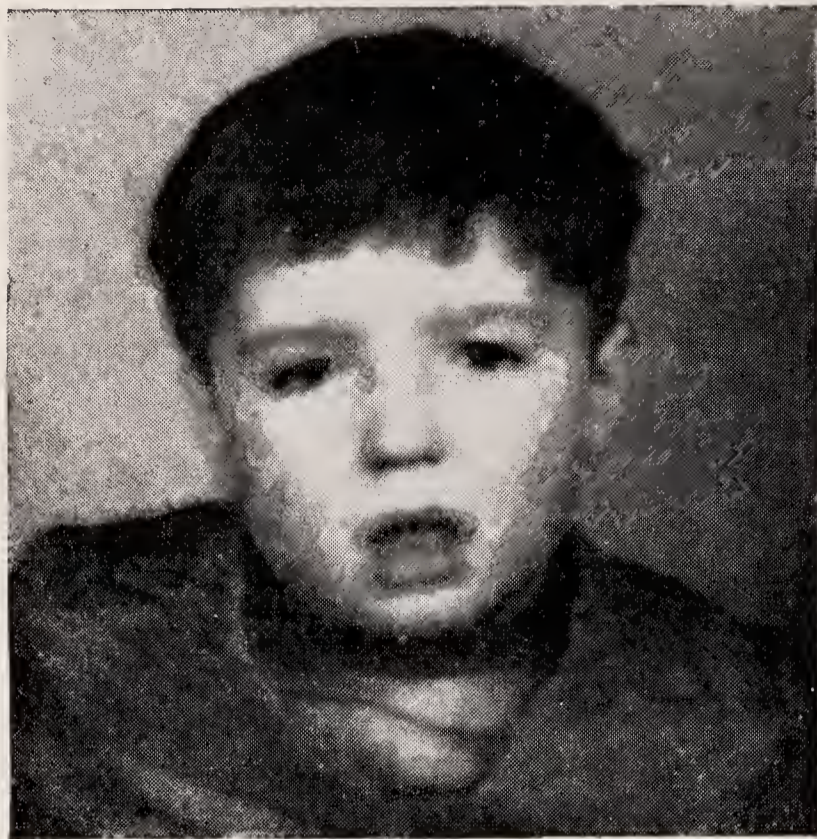
I am sorry to burden you with matters seemingly so far outside the Orthodontic field but the dento-alveolar substance is set on a bony base within a group of reciprocal muscles whose behaviour is re-shaped as the feeding and breathing mechanisms mature. Not only this, but both Rix and Ballard have also pointed out the significance of persistent infantile patterns of muscle behaviour in relation to mal-alignment of the teeth.

Perhaps the reason for my digression will become more plain when I say that we are adopting the Andresen appliance as a means of supplying the necessary patterned stimuli to which the cerebral tissue will react. We hope that by its use, not as an intra-oral splint, but as a cast of a closed rigid-walled oral cavity, to build up a mental image of a mature pattern of mouth behaviour in the brain, and that infantile characteristics will be inhibited.

We are particularly interested in thumb-sucking and mouth-breathing; both are closely related infantile characteristics. Whereas we regard thumb-sucking as a residual phenomenon of the infantile hand to mouth reaction that commonly recurs in moments of emotional stress and concerns the Orthodontist more than the Rhinologist, we believe that mouth-breathing is by no means always secondary to nasal obstruction but often a manifestation of delayed maturation of the behaviour of the facial musculature which concerns the Rhinologist more than the Orthodontist.

We take the view that growth patterns of the jaws (i.e., basal bone) are pre-determined genetically and are unaltered by either of these functional disorders, but when thumb-sucking persists, the dento-alveolar pattern may be profoundly disturbed. In mouth-breathers, however, we have found that the dento-alveolar pattern is not necessarily affected unless there are other abnormalities of muscle behaviour present which can be recognized clinically as residual characteristics of the sucking pattern.

Brodie and others have been unable to influence the relationship or form of the bony structures. We have, therefore, decided to make every effort to assist maturation of muscle behaviour and particularly to inhibit infantile characteristics which, if allowed to persist for too long, would influence adversely the growth of the dento-alveolar pattern,



(a)



(b)



(c)



(d)

Fourth Series

RE-EDUCATION OF HABITUAL MOUTH-BREATHER

(a & b) *Facial pattern before using monobloc.*

(c, d, e & f) *Facial pattern after using monobloc for three months.*



(e)



(f)

By observing the order in which developmental patterns appear, Gesell in America has been able to evolve gradients of growth which can be used as yard-sticks to measure a child's progress, or to say whether one particular form of behaviour is normal at one stage, yet abnormal at another.

Speech therapists already are solving many of their problems on similar lines of approach by observing the succession of developmental patterns that appear as the muscles of the tongue, lips and palate are combined in sound play, speech and language behaviour.

The more I have thought about the control of thumb-sucking and associated sucking habits in relation to dental irregularities or of mouth-breathing in relation to upper respiratory infection, the more certain I have felt that we also should be concerned not only with the order, but with the timing of the successive patterns of behaviour that make their appearance as the feeding and breathing processes reach a stage of maturity.

This will form part of our work in the future, but for the moment, we can only review some of the changes that take place.

The behaviour pattern of the oro-facial muscles in sucking and squirting fluid into the pharynx is entirely re-shaped as the central nervous system organizes the musculature for chewing and swallowing semi-solid food.

As far back as 1888, Auerbach drew attention to the fact that there must be an enlargement of the oral cavity with the mouth closed to produce a negative pressure in the act of sucking.

To use his own words, "... this enlargement will be greatest if in the beginning, the smallest possible airless space is present. We have therefore to consider, that with the mouth closed, the dorsum of the tongue is nearly completely applied to the hard and soft palate, so that only a minimal air-containing space is present near the tip . . . "

With the mouth closed, "... the simplest way to enlarge the oral cavity is by the lowering of the jaw . . . " He does not ascribe

to the cheeks any active part in this process, other than that they supply firm although soft walls to the enlarged oral cavity.

According to his observations, this explanation appeared to be correct up to the fourth or fifth month of life. “. . . But to this is then added another mechanism which becomes more and more prominent while the movements of the jaw become less and less marked and finally disappear completely.” He continues to point out that this change consists in a separation of the tongue from the hard palate also in a downward direction. It takes place first, “. . . at the tip of the tongue and progresses to the summit of the convexity of the back of the tongue, stops here and rarely extends further to combine with a separation of the posterior part of the tongue.”

Our researches are admittedly incomplete but we have investigated the behaviour of the posterior oral muscles in breathing and sucking by means of profile radiography of the soft tissues. We have found that in nasal breathing among infants and young children, the tongue almost completely fills the inter-maxillary space whilst the shadow of the soft palate is moulded round the base of the tongue. Sometimes, there may be a small air space between the tongue and palate, but this space is completely obliterated by the act of sucking.

Although our observations confirm Auerbach's conception, particularly with regard to the fact that the palato-lingual space is closed during the act of sucking, the point of greater interest is that he describes *one* change in the behaviour of the musculature.

Bieber (1940) included in the behaviour of the sucking response, lip pouting, mouth opening and tongue protrusion. With the advent of spoon feeding, the sucking response is modified and the behaviour of the oral muscles undergoes a change as the pouting of the lips is replaced by a drawing in of the lips over the spoon.

As the tooth-bearing margins grow and the teeth erupt, the space between the gum pads is gradually lessened and a further adjustment in muscle behaviour is brought about. In response to biting, the masticatory muscles are laboriously co-ordinated in the process of chewing and the lateral thrust of the tongue forces the food between the teeth. The facial musculature, no longer necessary as part of the wall of the oral cavity, now performs the function of keeping the vestibule of the mouth clear of food. On swallowing, the jaws are held firmly together to form a rigid wall which allows the backward propulsion of the food into the pharynx by the tongue and mylohyoid muscles.

Rix has pointed out that the facial muscles take little or no share in the swallowing process and that only in drinking or sucking fluids is a space left between the teeth. When resting, the functional closure of the inter-maxillary space is determined by the reserves of tonus built up among the masticatory muscles to overcome any effect of gravity on the mandible. Closure of the orbicularis oris, however, is more dependent on the play of attendant muscles of facial expression that characterize the individual. Gesell, who has applied the principles of maturation to the movements of the mouth which he has traced through infancy to childhood, lays stress on the fact that “. . . control is primarily achieved by the slow and steady progress of maturation,”

With regard to the changes that occur in the behaviour of the muscles concerned in nasal breathing, we must remember that in infancy, the facial muscles are flaccid and closure of the lips is but part of the total behaviour pattern of the oral musculature involved in the sucking process.

After the first few months of life, when spoon feeding is introduced, there appear to be many infants who only keep their lips closed when sucking a dummy or their thumb. We have repeatedly observed, however, that an open mouth is not necessarily indicative of mouth-breathing but that the tongue almost completely fills the space between the jaws and the palatal velum forms a tense low arch which meets the posterior mass of the tongue to close off the oral cavity from the airway. The faucial pillars, tonsils, and the oro-pharynx are not exposed and efforts to depress the tongue are met with considerable resistance by the lingual muscles.

Our observations have led us to believe that normally, the tongue and soft palate are so far in contact one with the other in young children that not only is there an effective posterior oral seal during the act of sucking but a muscular barrier to oral breathing. We also have evidence to show that this pattern may persist throughout life, but when sucking is no longer the predominant method of feeding, the tongue may fall away from the palate, particularly in the "hypotonic state" of some children. Should there be an added incompetence of the anterior oral musculature, mouth breathing will supervene.

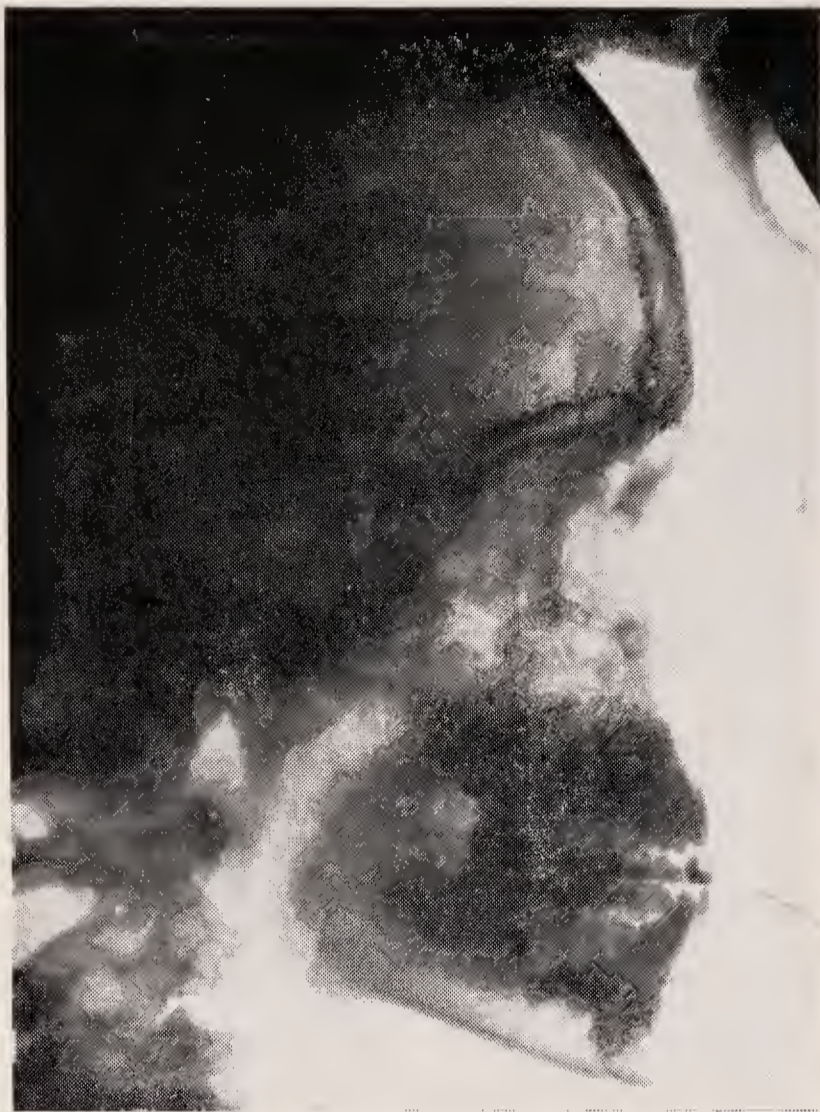
To sum up—as the structure of the nervous system develops, and as the oral musculature comes into the conscious plane, both the feeding and breathing processes rely more and more on the maturation of the behaviour of the masticatory and facial musculature, but less and less on the reflex co-aptation of the tongue with the palate.

It is common experience to find that an infant will persist in breathing through the nose in spite of partially occluded airways. The only satisfactory explanation seems to be that the behaviour of the musculature has been so "patterned" by the central nervous system before birth that oral respiration does not supervene unless there is gross nasal obstruction, or undue relaxation of the musculature, or when the respiratory centre may be so far affected that demands for adequate oxygenation must be met.

I grant that mouth-breathing may be the result of habit following nasal obstruction in the past, but I cannot accept this explanation as a complete answer.

When we come to consider that in infancy there is a gap between the jaws and that the facial muscles are flaccid, the facial characteristics of the classical "mouth-breather" closely resemble those of the infantile countenance.

A dull mental outlook rather than a low intelligence level reflects a subnormal or delayed "upper motor neurone" influence. This is the primary factor responsible for the mask-like facial expression, and the open mouth is but part of the clinical picture. It is not that the musculature cannot be co-ordinated but that the new patterns have not become dominant, and there are times when the child does not choose to utilise his muscles. It is then that the child assumes the appearances of the so-called mouth-breather,



I. 'IDEAL' NORMAL SOFT TISSUE
AND SKELETAL PATTERN.

Note :—*Unimpeded post-nasal airway ; co-aptation of tongue and soft palate ; functionally closed intermaxillary space.*



II A

II. SOFT TISSUE PATTERN
OF 'OBSTRUCTIVE
MOUTH - BREATHER.'

A. Note :—*Obliteration of post-nasal airway by large pad of adenoids ; open air-space between tongue and soft palate ; failure in closure of intermaxillary space.*

B. Same case, following removal of tonsils and adenoids.

Note :—*Free airway ; closure of air-space between tongue and soft palate ; functional closure of intermaxillary space.*



II B



III A



III B1

III. SOFT TISSUE PATTERN OF 'RELAXED MOUTH-BREATHER.'

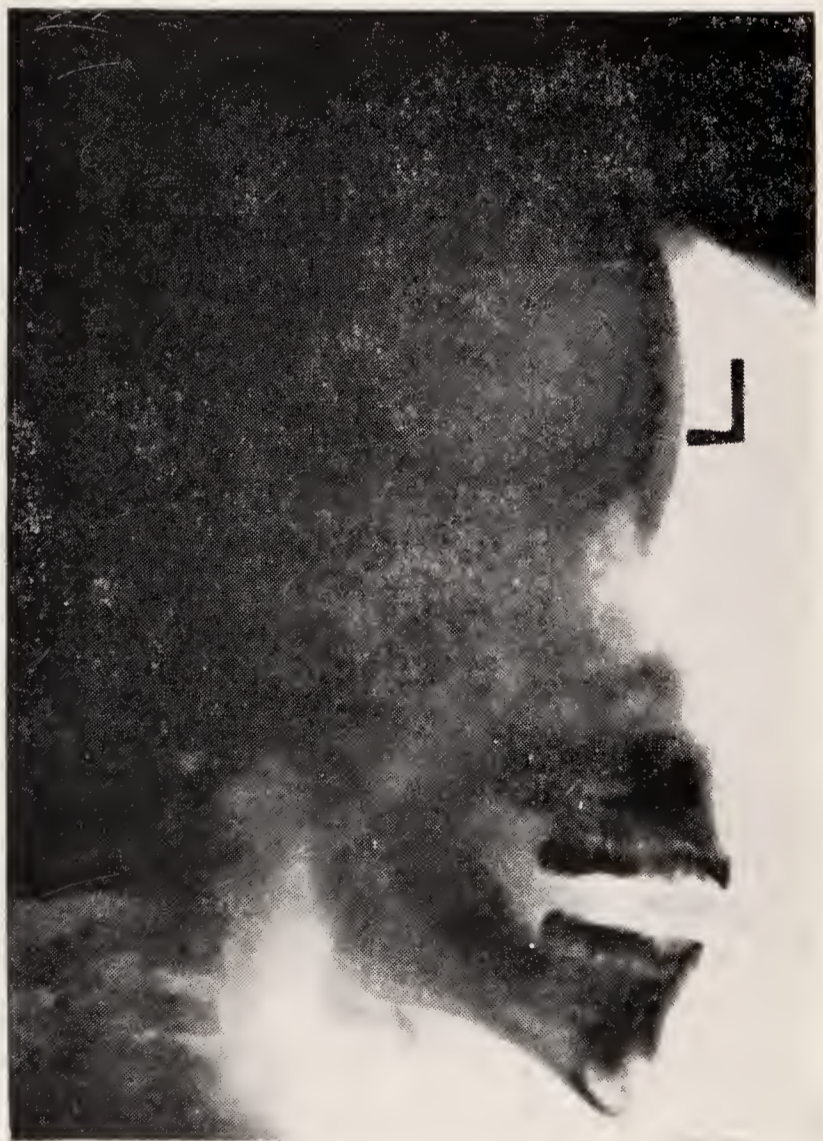
A. *Narrow but free post-nasal airway ;
open air-space between tongue and soft palate ;
dropped mandible.*

B. *Same case showing soft tissue pattern
obtained on sucking.*

B1. *Teat of feeding bottle.*

B2. *Finger.*

Note :—*Closure of air-space between tongue
and soft palate.*



III B2

With regard to the dropped mandible, "the teeth apart" position of the jaws is as much a feature of the mouth-breather as it is of the "infantile swallow" described by Rix, so that I have wondered whether the failure to maintain closure of the inter-maxillary space in mouth-breathers is not in itself largely due to immaturity of muscle behaviour.

It should be remembered, however, that the clinical picture of the so-called mouth-breather is not necessarily indicative of true mouth-breathing which only supervenes if there is a falling away of the tongue from the palate, or if there is direct interference with the palato-lingual muscles due to enlarged tonsils and adenoids.

We might pause at this juncture to see the second film strip. The children appear in an ascending sequence this time, i.e., we start with an infant, review some of the infantile characteristics of muscle behaviour and end with a child well matured in motor control.

1. Here is an infant with his mother ; the facial muscles are flaccid and impassive ; the open mouth is but part of the clinical picture.

2. A child of 18 months. The behaviour of the orbicularis oris is dependent upon the play of attendant muscles of facial expression.

3. An emotionally unstable child of three years of age. In crying, there is a total reflex response of the oro-facial musculature without expressive movements.

4. This child is in the phase of transition from infantile to mature patterns of behaviour. Both old and new patterns are present. One moment he co-ordinates his muscles in a proper manner and in the next instant, fails to do so. The new patterns have not become established and he easily reverts to a sucking response.

5. Brothers, aged three and seven years, illustrating persistence of the infantile facial expression in the older child. The open mouth is but part of the clinical picture and as you will see, is not always indicative of mouth-breathing.

6. The next two children are not related, but they are so alike, that they demonstrate the similarity of basic behaviour patterns. The boy has large tonsils and adenoids ; the girl has had the tonsils and adenoids removed. Both children are habitual mouth-breathers. Although the facial muscles respond to emotional reactions, there are times when they do not choose to utilize their muscles and their mouths remain open.

7. A child well matured in motor control. Emotional reactions are inhibited. Infantile characteristics are absent. The swallowing and breathing mechanisms are of the normal adult pattern.

8. By contrast, this child exhibits the immature patterns of muscle behaviour in swallowing, as first described by Rix. The facial muscles are poorly co-ordinated and the sucking pattern is easily recognized. The thrust of the tongue is through the separated teeth.

9. The next few pictures illustrate the behaviour of the anterior and posterior oral musculature, more specifically.

1. The orbicularis oris, in closure of the mouth.

2. The reflex co-aptation of the tongue with the soft palate in closure of the faucial isthmus whilst breathing through the nose with the mouth open.



IV A

IV. SOFT TISSUE
PATTERN OF
'RELAXED'
MOUTH-BREATHING.

A. *Without Monobloc.*

B. *Same case showing
soft tissue pattern obtained
on sucking Monobloc.*

Note :—*Functional closure
of palato-lingual air-space
and inter-maxillary space.*



IV B

3. Reflex arching of the tongue and voluntary elevation of the palatal velum.

4. The opening and closing of the faucial isthmus when deliberately mouth-breathing and sniffing respectively.

5. An abnormally close relationship between the uvula and epiglottis. (An elongated soft palate and efficient epiglottis are normally in contact in herbivorous animals who depend upon their olfactory sense when feeding. (Negus).

6. The behaviour of the palato-pharyngeal musculature in swallowing.

7. The rise of the base of the tongue and larynx in swallowing.

I have included a few profile radiographs of the soft tissues.

A. *NORMAL PATTERNS.*

1. Showing closure of faucial isthmus :

(a) At rest.

(b) Mouth half open.

(c) Mouth wide open.

2. Showing opening of faucial isthmus by voluntarily relaxing the palato-lingual muscles.

3. Showing closure of naso-pharyngeal isthmus, on phonating "Ah," soft palate forms roof of pharynx proper.

B. *ABNORMAL PATTERNS.*

1. Relaxed pattern showing the falling away of the tongue from the palate in the presence of diminished tone. (Actually a case of myasthenia gravis.)

(a) At rest.

(b) Mouth open.

2. Obstructive Pattern, showing obliteration of post nasal airway by large pad of adenoids :

(a) Before T's and A's were removed.

(Tongue held away from palate to allow mouth-breathing.)

(b) After T's and A's were removed.

(Palato-lingual space closed. Wide post nasal airway.)

When we come to consider management of these cases, we should remember that as far as the motor behaviour of the oro-facial musculature is concerned, we are dealing primarily with groups of muscles whose movements are patterned within the central nervous system long before birth, and that some children reach a stage of maturity much later than others.

We take the view that there is frequent delay in the normal adjustments made in the progress towards higher levels of behaviour and we feel that a key might be found to supply the necessary stimuli which would allow the nervous system to play its part in developing the natural sequence of behaviour patterns.

I think the Andresen appliance in a modified form may prove to be that key.

I am not an Orthodontist, so that I am open to correction on this or other points, but I gathered from the symposium delivered by Endicott, Grossmann and Pedley previously this year, that the Andresen appliance may be used to employ muscle forces for the movement of teeth on the principles of the inclined plane or inter-maxillary traction, and in various other ways.

We have adopted the "Monobloc" principle of the Andresen appliance not so much as an intra-oral splint to employ muscle

forces for the purpose of moving teeth, but as a cast of a closed rigid-walled oral cavity, with the intention of deliberately bringing about a change in mouth behaviour.

We believe that at birth, nasal respiration is just as dependent on the high degree of co-ordination between the posterior oral muscles involved in sucking as the act of sucking itself is dependent upon a free airway apart from the oral cavity. So that our first line of approach to the control of mouth-breathing and sucking habits, has been to use the Andresen appliance or Monobloc, as we prefer to call it, as a stimulus to obtain a complete sucking response. The tensor veli palati muscle is the only muscle of the soft palate supplied by the mandibular division of the fifth cranial nerve. By employing serial profile radiography of the soft tissues, we have found that when the full sucking response is thus obtained, the tensor muscles of the soft palate are included and the palato-lingual space is automatically closed. The anterior oral musculature envelopes the appliance and whilst thus pre-occupied, nasal respiration will continue.

The appliance is designed to be quite loose in the oral cavity and is constantly falling away from the maxilla only to be replaced by the musculature closing the jaws. So that our second line of approach has been to use the Monobloc as a means of providing repeated stimuli to cause a functional closure of the inter-maxillary space.

Our third line of approach has been to use the appliance as a stimulus to effect a change in the behaviour of the oral musculature on deglutition. The upper and lower dentitions are integrated on swallowing and a rigid-walled oral cavity is provided for the proper behaviour of the tongue and particularly the mylohyoid muscle.

The appliance need only be used during rest periods in the day, but it should remain in the oral cavity all night for sub-conscious movements of the musculature and recurrent acts of swallowing are present even in sleep.

The Monobloc provides the child with a sub-conscious mental picture of a closed oral cavity and the groundwork of a mature pattern of behaviour is thus prepared. Young children are not aware of the sensations and movements of the muscles that develop out of the tasks set before them, but given those tasks, the musculature is utilised in a proper manner and a mature behaviour pattern will grow out of the sucking pattern probably much in the same way that given the opportunity, " . . . specific arm or leg movements grow out of the attitudinal reflex " laid down in uterine life. (Bartlett.)

Wrong habits of co-ordination if already established, may need breaking down to basic levels of muscle behaviour before new habits of co-ordination can be built up again.

Once the behaviour of the oral musculature has been re-set, exercises in the form of play will help to train the facial muscles in finer habits of co-ordination and control ; if they are used before this stage is reached, they may prove to be useless and a waste of time.

As far as the control of mouth-breathing is concerned, we are not only interested in ventilation of the nasal airways, but also in drainage of the post nasal space. The pharyngeal wall of the mouth-breather becomes insensitive to oral breathing and any subsequent

lack of recurrent sub-conscious acts of swallowing will increase the liability for naso-pharyngeal secretions to stagnate or follow the alternative physiological route into the tracheo-bronchial system. We have hopes, therefore, that renewed acts of swallowing induced by the presence of the appliance in the oral cavity will encourage reflex drainage of the upper respiratory tract, particularly at night when droplet infection into the lungs is most likely to occur.

In conclusion, I would say that whilst disturbances of muscle behaviour may be corrected only as far as the development of the central nervous system will allow, a similar limitation will probably apply to the regulation of the dento-alveolar structures, in that they too may be adjusted only as far as the growth pattern of the jaws on which they are based will allow.

Up to the present time, we have only plotted our course in assisting the child to grow up, so that we do not know how far our objects will be achieved. If, as we suspect, that in addition to hereditary factors in skeletal growth, we have to contend with disturbances of muscle behaviour that are also transmitted from one generation to another, then our path may indeed become a stony one.

I should now like to show you two of my cases with functional disturbances of the oro-facial muscles which I referred to Mr. Nove; one was a true mouth-breather; the other had a tongue-sucking habit. That there was improvement in the performance of the musculature following the use of the Andresen appliance, there was no doubt. Unfortunately, I found myself unable to accept his views as an explanation, but I should like to make it plain that to Nove should go the credit of first observing and pointing out to us the potentialities of the Andresen appliance as a means of correcting functional disturbances of the oro-facial musculature.

The third case is an established mouth-breather which we are treating at the present time:

- (a) Before the tonsils and adenoids were removed.
- (b) Three months after operation, showing that the clinical picture has not changed.
- (c) Three months after re-education of the musculature. Showing changes in the clinical picture as a result of using the Monobloc to encourage the utilization of the oro-facial musculature in a proper manner.

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DISCUSSION

Mr. F. C. W. Capps said that he deeply appreciated the honour done to him, in inviting him to open the discussion. He felt that Mr. Gwynne-Evans, as an oto-laryngologist had had something to contribute to orthodontic study. Both he and Mr. Ballard had been working in his Department at St. Bartholomew's Hospital and he valued their work immensely in trying to unravel some part of the age-long tangle of upper respiratory troubles in children to which the tonsils and adenoids problem so-called had not given them the proper answer. The idea behind this work was that of Mr. Gwynne Evans. He set out during the war in the speaker's clinic to organise an investigation. They started with the assumption that the child constituted a different problem from the adult and that it should be possible to correct the child's disability while it was in a state of dysfunction and before it had become an established pathological state.

They started an ear, nose and throat investigation of children as the first stage in the proceedings. They encouraged numerous attendances in order to avoid a quick decision on a single consultation and to record progress and to make a study of environment so far as these children were concerned. The scheme as drawn up comprised an association of social conditions and environment and a clinical examination by an ear, nose, and throat surgeon and later by an orthodontist. He might remind the meeting that this was no new combination because as far back as 1932 Mr. Somerville Hastings and Mr. Warwick James published an admirable original article in the *Journal of Otology and Laryngology* in which they came to certain conclusions after their joint work. The conclusions were as follows:—

- (1) The urge for respiration through the nose is so great that mouth breathing is established with difficulty.
- (2) Oro-nasal breathing is uncommon. Oral breathing is rare.
- (3) A negative pressure is normally present in the oral cavity during inactivity.
- (4) A failure of one or both oral sphincters results in loss of negative pressure.
- (5) The loss of normal negative pressure in the mouth is associated with impaired action of the tongue, lips, cheeks, and other moulding forces of the jaws. The abnormalities of the jaws result from the impaired and misdirected action of these forces.
- (6) Failure of the anterior oral sphincter is common but does not indicate mouth breathing.
- (7) The failure of the posterior sphincter results in absence of fixation of the soft palate to the tongue with impairment of the airway.
- (8) Backward position of the mandible results from failure of either oral sphincter; it is most marked when both fail. Associated falling back of the tongue impairs the freedom of the airway.

- (9) Tension ridges upon the gums and mucous membranes mark off the areas where compression of the tissues exists from where it is absent.
- (10) Nasal obstruction by adenoids rarely occurs although the associated catarrh and swelling of the erectile tissue may diminish the airway.
- (11) Deformities in the nose may cause obstruction but are not caused by it.

One interesting observation following from this work was that when they went to the sister of the infants' ward she told them that when babies were very ill their facial muscles were much more relaxed and they habitually had their mouths open. As they recovered their health their facial muscles improved and got back to a more normal facial pattern.

To return to the clinic: After the clinical examination there was a soft tissue exposure over the post-central space. Ideally, of course, it was desirable that the respiratory tract as a whole should be considered. They were too much in the habit of separating bits off, and he thought they ought to work together over these things. It was essential that a clinic of this sort should have a pediatrician associated with it. He was glad to say that now they had the goodwill of the children's department and he had no doubt that they would enter into the spirit of this investigation. There was always a dangerous tendency of special departments of medicine to become divorced from the wholeness of medicine and in this connection he regarded orthodontics and other branches of dental surgery in exactly the same light as medicine. The more they got together the happier they would be. This little clinic had brought together minds interested in problems isolated from each other.

This question of basal bone and dental alveolar structures was rather different from his own orbit, but he desired to hear the argument on both sides and to act as an impartial arbitrator. Mr. Gwynne-Evans's thesis that they should combine their resources to bring about the devolution of the mouth breather was a right and proper one. The mouth breather as such was a *rara avis*. In 1939 one writer reported on 100 children between the ages of 2 and 14 who slept with their mouths open and out of this 100 only 80 breathed through the nose exclusively, 14 breathed through the nose and mouth alternatively or coincidentally, and only 6 breathed entirely through the mouth. Therefore they were not dealing here from his point of view only with mouth breathers, but with all those things which caused obstruction in the upper respiratory tract—diseases of the sinuses, enlargement of the lymphoid tissue, and definite congenital deformities in some cases. Œdema of the erectile tissue in the nose might occur as a result of various infections.

Lastly, there was perhaps the red-herring of allergy of which they had fought shy. They had got to face up to the question sooner or later. Many of the children who had obstructed respiratory passages were purely allergic in their obstruction. He was there that evening to hear from the members of the Society to what extent they thought that the deformities and maladjustments with which they dealt were the cause or the result of the upper respiratory embarrassments and what they thought of their methods of

muscular rehabilitation. The method of the Monobloc looked harmless enough. This work was only just at its beginning, and there was a great deal still to be done. It had been seen by other people and he knew that for one Mr. Ewart Martin had taken it up and was using it together with his orthodontic colleagues in Edinburgh.

Mr. R. E. Rix thanked the Authors for their valuable contributions. He thought they contained much that was of help for orthodontics. The behaviour of the muscles which served the dental arches was associated with the dental alveolar pattern of the jaws. Mr. Gwynne-Evans had postulated disturbance of function, a lack of control which led both to loss of muscular tone and persistence of infantile muscular behaviour. His film showing patients with poorly co-ordinated oro-facial musculature was most impressive, and especially so the evidence of persistence of the infantile act. His own impression was that children with an infantile pattern of behaviour, and, more precisely, those who continued to swallow in an infantile way, were likely to interest the orthodontist a great deal and nearly always gave a history of or showed some present signs of trouble in the nose and throat.

Could Mr. Gwynne-Evans say whether that was his impression? If it was, they might conclude that either the dental nervous system in prematurity predisposed the child to these ills or else that these ills operated to upset the muscular pattern. It was encouraging to hear of the use of the Monobloc and the report from Mr. Ballard and Mr. Evans on this subject would be most useful. The longer the disturbances persisted the harder they became to correct. He thought it problematical whether the Monobloc would of itself produce results in a child of 12 years. So often the children were brought to them with established dental irregularities and such irregularities once established acted adversely upon the alveolar structures.

Mr. A. A. Nove (whose remarks were not clearly heard at the platform) was understood to say that two things stood out very distinctly from what had been urged by the Authors and the observations made by Mr. Capps. One was that this subject was very young, and the other, arising out of it, was that in dealing with a clinical entity such as this the orthodontist and his fellow-specialists should tackle the problem in a co-ordinated manner.

He wished to say publicly how very grateful he was for this discussion.

Mr. M. A. Hovell said that he was interested in these papers mainly from the orthodontic aspect rather than from that of ear, nose, and throat research. It had been his good fortune since the war to have worked with Mr. Ballard at the Royal Dental Hospital, and he thought he could say that he knew and thoroughly understood his views on the ætiology of malocclusion which he had put forward in connection with his work on muscle pattern. Since using the criteria of normal skeletal and muscle pattern as the base for the diagnosis of malocclusion he had found the problem much simplified for him. Not only in the vast majority of cases was the condition apparent, but the prognosis could be studied with much more certainty, as this varied with the ability of the orthodontist to place the teeth in relation to one another while at the same time placing them in relation to the lips and tongue.

Mr. Ballard's system of orthodontic diagnosis and methods of treatment arising therefrom had in his opinion opened a new chapter in the history of orthodontics. He had produced order from chaos and had placed orthodontic diagnosis upon a truly scientific and logical basis which was completely in conformity with the modern conception of bone growth and skeletal pattern and heredity of both forms of behaviour. The valuable research on muscle pattern by Mr. Gwynne Evans might lead to entirely fresh methods in orthodontics, both preventive and curative. He asked whether Mr. Evans had used the oral screen as an appliance in his study of these patterns and, if so, in what cases had it proved a success and in what cases a failure.

Mr. C. L. Endicott said that he was very grateful to Mr. Ballard and Mr. Evans for their stimulating papers. It was evident that a great deal still remained to be found out on this subject. It was most difficult to discuss papers of this nature on the spur of the moment, and, for his part, he wanted to read Mr. Evan's paper in particular most carefully and then he would be able to ask him a number of questions—questions not perhaps answerable as yet. When he first saw the Monobloc he decided that he would not have anything to do with it, but ultimately he did decide to use it in a certain number of cases—not a great many. A great deal had still to be learned about it, but a number of very satisfactory results, though also a number of failures, had been obtained. The reason for the failures in difficult cases perhaps had been the lack of co-operation between those using different appliances.

Mr. Broadbent said he was working at Manchester Dental Hospital where they were fortunate enough to have the chance of examining 1,300 schoolchildren who went to free schools. An odontological examination had been made and the conclusion arrived at with the first 500 was that the arch form and the relationship of the mandible had very little relevance to the question as to whether or not children had been fed at the breast or bottle-fed. They consulted with some of the staff at Manchester Royal Infirmary and the first question they put to him was whether he was aware that sucking as a negative pressure in the mouth was not always necessary. With that in view an examination was made of certain mothers feeding their children, and it was shown that in some cases so far from producing the milk by suction, a slight stimulation of the nipple was sufficient to produce a jet of milk.

The Zoology Department pointed out that this was quite common in animal life and stated that in the kangaroo actually a jet of milk was flung back upon the œsophagus and a special action came into play to prevent the young kangaroo being choked. The sucking action therefore was not necessary. He went on to describe another experiment on oral secretion which went to show that generally speaking the mouth breathing child had less muscular tone on the orbicularis oris, but that much depended also on the mental state of the child and whether he was interested in the problem or not. He asked whether it was the opinion of the Authors that there was any evidence as to the negative pressure usually in the mouth of the suckling child.

The President said that he was interested in Mr. Gwynne Evans's description of the increasing control over the muscles as the child got older. A lot of them must have had in mind the analogy

of the young child trying for the first time to walk alone and having a spastic gait and lack of control. The same thing probably applied in the use of the facial muscles. Mr. Evans had mentioned the intermediate state which he thought would be interesting. He had spoken of thumb-sucking, and here the question of the control and development of the thumb in the young child was of importance. It was something which distinguished the human child from the ape. It would be interesting to have Mr. Gwynne Evans's comment on whether the muscular control of the thumb was also a point in the set-up of control of the dental muscles.

In 1932, in the *Transactions*, under the heading of "Normal Occlusion" he had shown something very similar to what had been shown that evening and he had then drawn attention to the fact that many of these cases were much more noticeable in hospital than in private practice, the children seen in private practice living under conditions of feeding and so on which were kinder to them.

Mr. W. Grossmann said that many of their failures had been due to the fact that they had moved teeth into occlusion, but they had not paid attention to the muscular and other factors to which the Authors of that evening had referred.

He wished to ask Mr. Ballard why he differentiated between basal and alveolar bone.

Mr. Gwynne Evans, in reply, said that he had been interested in Mr. Rix's question, which was very difficult to answer because they did not yet know what were the causes of large tonsils and adenoids. These might be due to hereditary factors, malnutrition, or infection. He had in mind a recent very interesting case in which one side of the face was larger than the other. The difference applied to various structures, and, strangely enough, there was a very large tonsil on one side. He thought that enlargement of the tonsil had something to do with the growth factor.

On the question of upper respiratory infection, they were dealing there not only with ventilation of the nasal spaces but also with post-nasal drainage, and should there be any disturbance of the act of swallowing there would be stagnation. Where abnormal behaviour patterns would contribute towards upper respiratory stagnation, he thought the abnormal swallowing pattern was more related to the orthodontic field than to his own. He, of course, was much concerned with upper respiratory infection.

Mr. Hovell had asked about the oral screen. He had had no experience of this. He thought the Monobloc would replace it, but he saw no reason why the screen should not be useful in certain cases.

He had been interested in Mr. Broadbent's contribution and he would like to discuss with him sometime the whole matter of suckling. He had gone to much trouble in the library of the Royal Society of Medicine to look up the literature of suckling and he found one very good article by Beaver in 1940, but otherwise there was a complete blank on the subject.

The President had set him a problem concerning the developmental patterns. The association of the sucking reflex and the grasp reflex in infancy was carried on into the hand-to-mouth reaction, and if small children were watched it would be found that they would first grasp an object in their hand and eventually begin

to differentiate the movement of the fingers and thumb, and finally the thumb and index finger, instead of grasping an object, would pick it up. Much research had been done on this subject in America.

On the subject of the difference between hospital and private practice, he thought it was because rickets and hypertonia were so closely associated that they saw more of these cases in hospital than in private.

Mr. Ballard, also in reply, said that he agreed with Mr. Rix that certain forms of abnormal swallow were difficult to treat. The tip of the tongue came between the upper and lower incisors. He thanked Mr. Hovell for his flattering remarks. He agreed that the oral screen did on occasion produce the same result as the Monobloc. Probably the child did attempt to suck this between the incisors, but he thought that on the whole an oral screen was less reliable.

He agreed with Mr. Endicott that a large amount of research yet remained to be done. They wanted a detailed study of about 3,000 children with due regard to skeletal and muscle patterns.

Mr. Grossmann had asked him why he differentiated between basal and alveolar bone. This seemed quite obvious; alveolar bone responded to pressure through the teeth in a way in which no anatomist or physiologist would agree that basal bone responded. He felt that there was that fundamental difference between the two. The alveolar bone responded to pressure on the teeth and the basal bone did not.

The President expressed the thanks of the meeting to the Authors and also to those who had taken part in the discussion, particularly Mr. Capps.



UNERUPTED TEETH

By

HAROLD G. WATKIN, L.D.S. (Liv.)

The object of this paper is, firstly, to show how buried teeth may be brought into position and, secondly, to emphasize the importance of recognizing any deviation from the normal dentition having regard to the age of the patient.

Fig. 1 shows a typical case of delayed eruption of 1. In a great majority of such cases the cause is a supernumerary tooth blocking the eruption of the normal tooth. If there is sufficient space between the adjoining teeth the treatment consists of the removal of the supernumerary. The buried tooth will then erupt into position by natural forces.

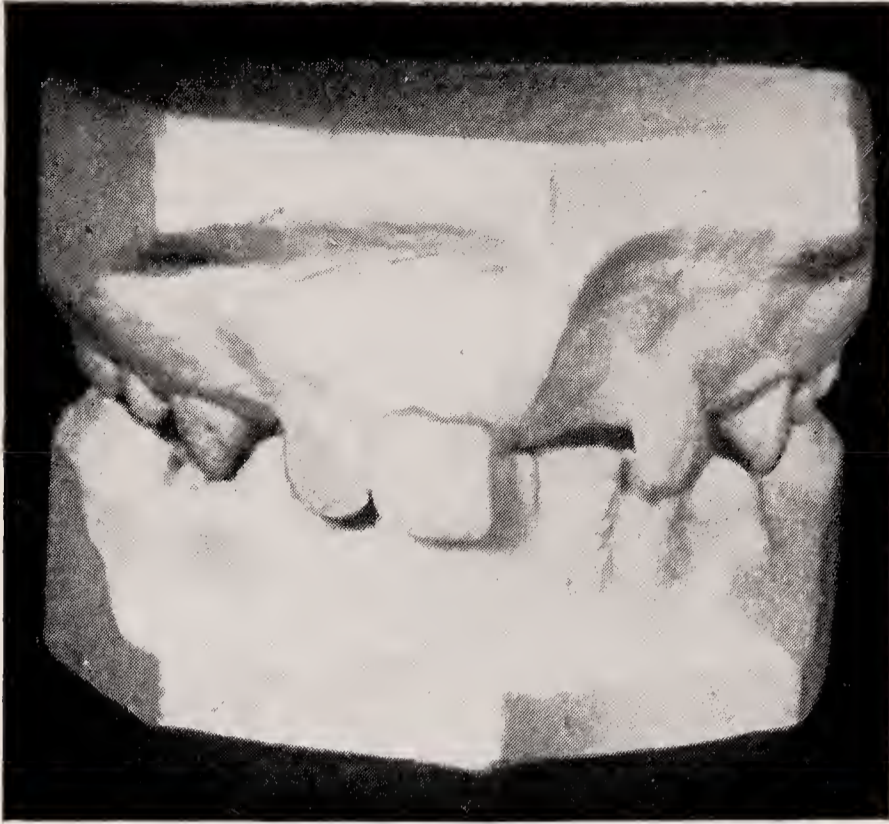
It is most important that, before attempting to remove the supernumerary, its exact position should be ascertained by radiographic examination. An intra-oral film should be placed in position and an exposure made. On removal the film should be marked 'L' (left) and a second film placed in a similar position but with the tube moved to the right for a distance about equal to the width between the eyes; this film should be marked 'R' (right). When the films are processed they should be placed in their relative positions—i.e. the left one to the left and the right one to the right. The two films can then be viewed with a stereoscope, when the position of the supernumerary tooth will be clearly defined. It is not, however, necessary to employ a stereoscope if a little reasoning is used. An analogous phenomenon occurs when one is travelling in a train. In this case, the telegraph poles along the side of the track appear to be moving in the opposite direction to that of the train but a church spire some miles away will appear to be moving in the same direction as the train. If the supernumerary has moved in the same direction as the tube, in relation to the neighbouring teeth, then it simulates the church spire and is, therefore, farther away from the tube than these teeth—i.e. it is in the palate and not in the sulcus.

Fig. 2 shows two films taken in the manner described above. It will be seen that both supernumeraries are palatal to the incisors.

The operation of removing the supernumerary is, as a rule, much easier than one would expect. A small flap of the mucoperiosteum is reflected and the superficial bone removed with a round bur. The hard surface of the supernumerary can then often be felt contrasting with the soft bone. The bur is worked round the tooth, which will probably drop out. If not, it can be removed easily with a suitable pair of fine forceps or with elevators. The flap should then be sutured back.

Fig. 3 shows 1 moving into position.

If there is not sufficient room for the suppressed tooth, space must be provided in addition to removing the supernumerary.



*Fig. 1.
Original
condition.*



*Fig. 2.
Film show-
ing super-
numeraries.*



*Fig. 3.
| 1
erupting.*



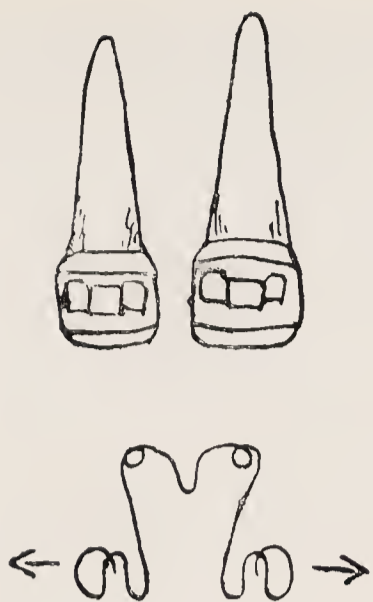


Fig. 4—Local “Pin” and Tube appliance for widening the space between the incisors. The inverted U’s fit into the vertical tubes on the incisor bands. The ends of the wire form effective latches.

Fig. 4 shows a simple ‘Pin and Tube’ apparatus to widen the gap when necessary.

If the long axis of the erupting tooth is at a considerable angle to that of its neighbours, the tooth may be impacted and will not erupt without help.

Fig. 5 shows 1 impacted against 1. After maintaining the space for three months no progress was made. 1 had to be pushed clear of 1. This was accomplished by drilling a hole (under local anæsthesia) in the alveolar bone medial to the crown of 1. A .3 mm. wire was then bent as shown, with one end attached to 1 by ‘Pin and Tube’ and the free end bent and inserted in the prepared hole. The spring of the wire was arranged to separate the teeth.

Fig. 6 shows the impaction cleared and 1 erupting.

Fig. 7.—Models of case before treatment.

Fig. 8.—Models of case during treatment showing 1 erupting naturally.

Fig. 9 illustrates the actual wire placed on the model showing the very high position of 1 when impacted. The wire is, of course, shortened as the tooth erupts.

Fig. 10. In this case the 1 was horizontal and the apex of the root was obvious in the palate. The crown of the tooth was exposed and a small shallow pit drilled in the enamel to engage the end of the wire.

Fig. 11 shows the end of the wire pressing into the pit and the tooth nearly in position.

Fig. 12. Here are the models of a patient aged twelve years with 21 1 unerupted.

Fig. 13. The film shows 21 1 and two supernumerary teeth present. 2 2 and the two supernumeraries were extracted and 3 brought into position. 1 1 erupted naturally.

Fig. 14 shows the ultimate result—the tips of the canines have been ground to resemble the lost laterals.

A patient of twenty-two years of age was sent to me because 2 was loose.

Fig. 15 reveals the cause of this condition. The unerupted 3 had brought about the absorption of the root of 2. The 3 was very deep in the palatal bone and a 0.3 mm. wire, with a loop bent

(continued on page 199)

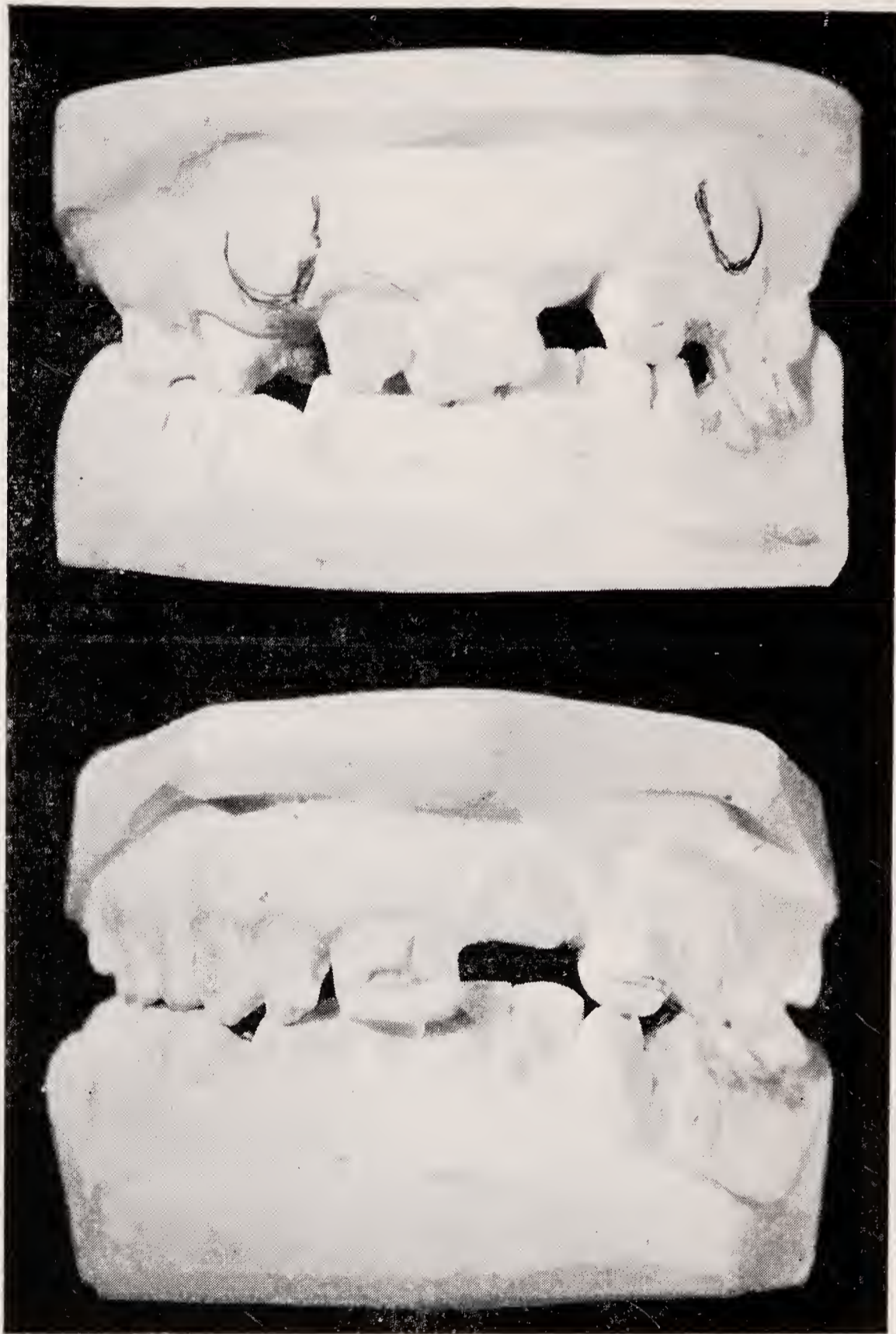
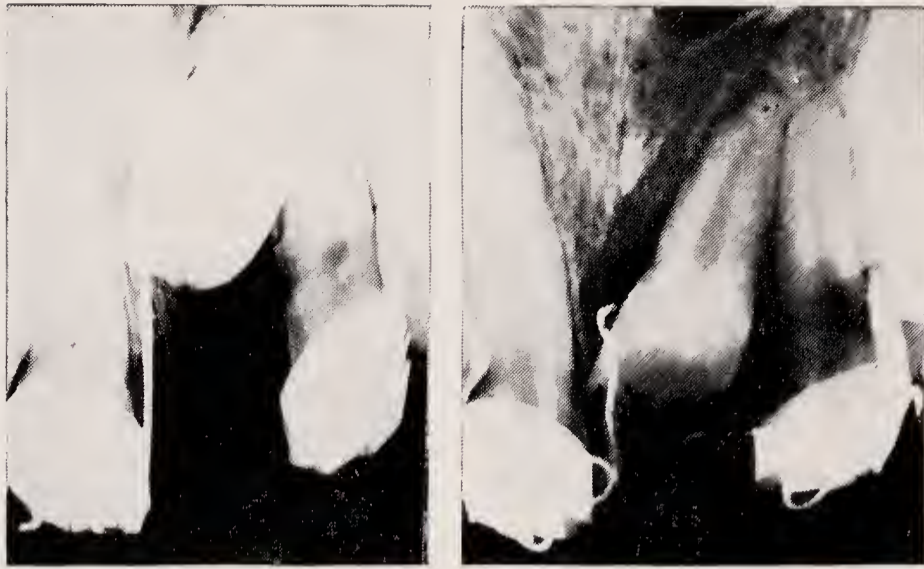


Fig. 5—Top left: $\overline{1}$ impacted against $\underline{1}$.
 Fig. 6—Top right: Impaction clear and $\underline{1}$ erupting.
 Fig. 7—Middle: Before treatment.
 Fig. 8—Bottom: During treatment showing $\underline{1}$ erupting.

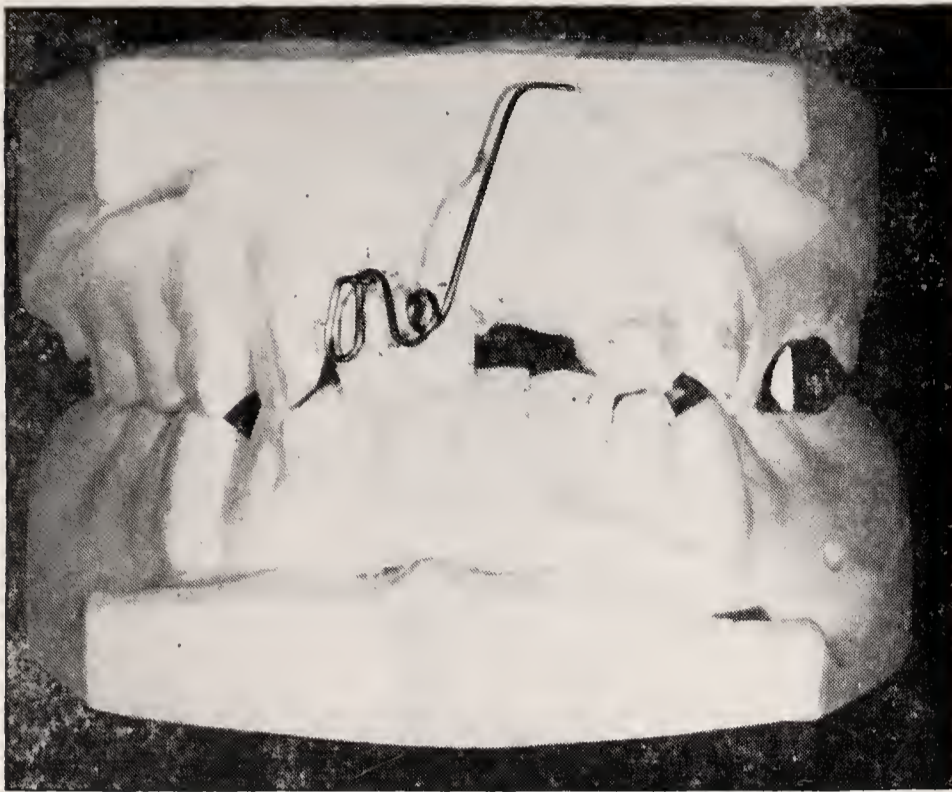


Fig. 9.
Actual wire
placed on model
illustrating the
very high posi-
tion of \perp
when impacted.



Fig. 10.
Films showing
rotation of \perp
round a hori-
zontal axis.

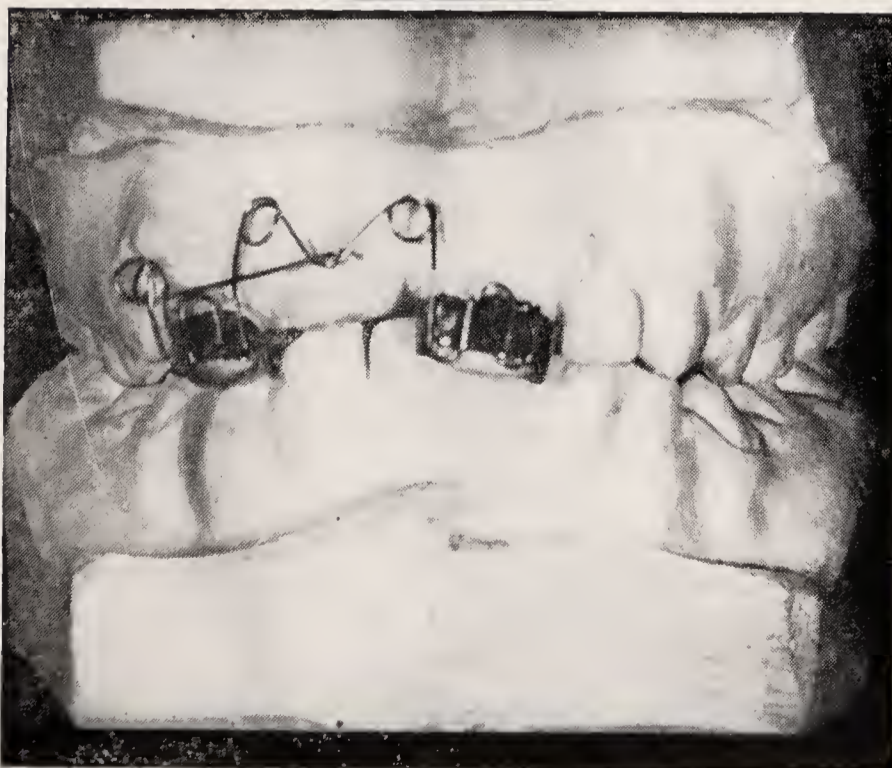


Fig. 11.
End of wire
pressing into
pit. Tooth near-
ly in position.



Fig. 12.
Original model age
twelve.

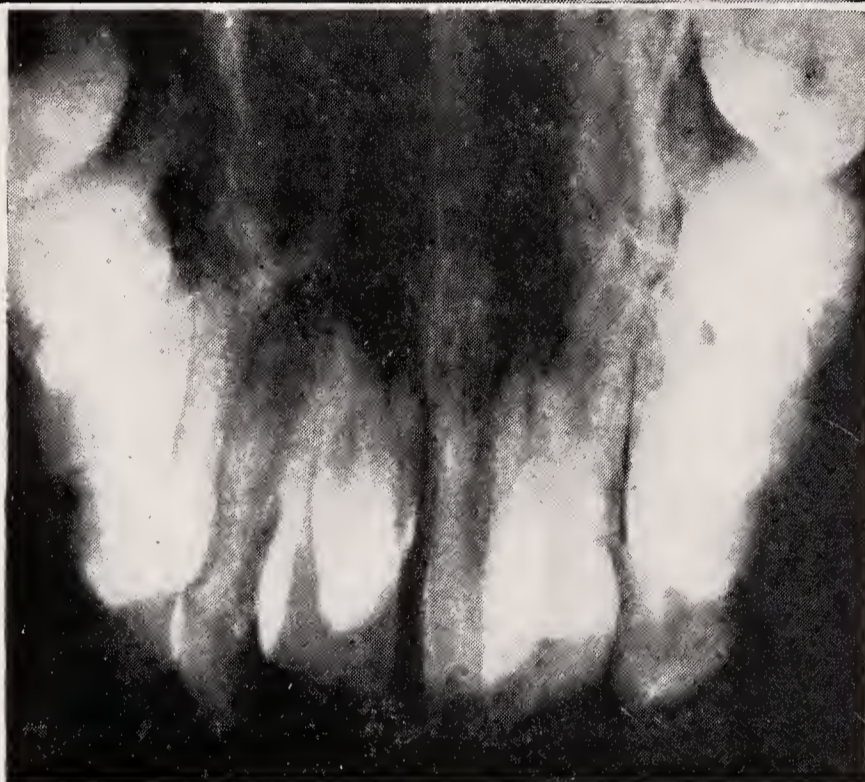


Fig. 13.
Film of above showing
21 | 1 and two super-
numeraries unerupted.

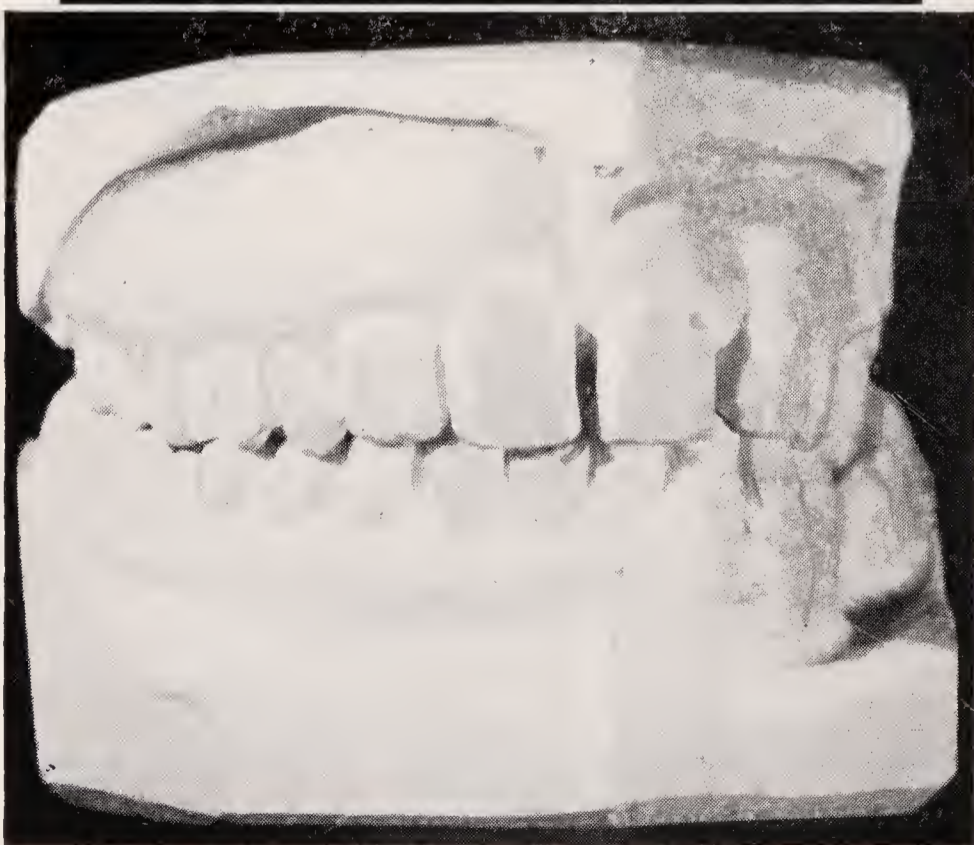


Fig. 14.
Result after treatment.



Fig. 15.
| 3 in palate. Root of
| 2 absorbed.



Fig. 16.
| 3 in position of ex-
tracted | 2.



Fig. 17.
Final result.

Fig. 18



Fig. 19

at the upper end, was cemented into a pit drilled in the lingual surface of the crown. The exposed end of the wire was bent into a hook and this hook engaged by a finger spring attached to a lingual body wire. The direction of pull of the fingerspring was adjusted at each visit in order to direct the $|3$ into its correct position. It is interesting to note that $|3$ was moved in the line of its long axis about $\frac{3}{4}$ " in a period of eighteen months and was still vital. The path of the movement of $|3$ can be clearly seen in the final film (Fig. 16).

Fig. 17 shows $|3$ in the position of $|2$ with its tip ground away to resemble the lateral.

Fig. 18. Here is an analogous condition in a patient thirty-eight years old. This patient presented with a swollen face and said $|2$ had dropped out a few years ago. He had to lose $|1$ and $|3$ and had a partial denture fitted. If the previous patient (Figs. 15 to 17) had not had treatment the same result would undoubtedly have occurred.

Another patient (age 25 years) complained of severe headache and general ill-health—she had to take anodynes constantly to make life bearable. The headaches began at the age of fourteen years; glasses were prescribed but there was no improvement. She travelled about a great deal and, during her travels, consulted several dentists about toothache which she was unable to localise. During eleven years (between the ages of 14 and 25) she insisted upon having eight teeth extracted in efforts to relieve her mysterious pain. In all this time no dentist radiographed her teeth or even noticed the absence of $|3$ in the arch.

Fig. 19. X-ray examination revealed the $|3$ in the palate.

After surgical removal of this tooth all her pain vanished, she ceased to take drugs and discarded her glasses. She is now in very good health.

Another patient developed epileptiform attacks at the age of fourteen years. All symptoms disappeared on the removal of an impacted upper canine. The age of fourteen is significant since the normal date of eruption of $3|3$ is the twelfth year and it usually takes about two years for symptoms to develop if, for some reason, eruption has not occurred.

A consideration of the above cases, which have been selected from many similar ones, will show at once the advisability of routine radiographic examination of the whole dentition at the age of fourteen and the immediate treatment of irregularities. This practice would obviate much future ill-health, both dental and general.



FACTORS CONCERNED WITH CLOSE-BITE

By
J. W. SOFTLEY, B.D.S. (Liv.)

While this paper is to be primarily concerned with close-bite I should like to open with some consideration of general orthodontic principles which might preface any paper on an orthodontic subject.

Because our patients are human they develop jaws and teeth which are characteristically human in pattern. From their ancestors too, they inherit factors which determine the extent to which the jaws and teeth can approach what we consider to be the ideal human pattern. Superimposed on these there are environmental factors which can modify the final result.

If we assume that in some cases all the environmental factors are favourable, the patient's jaws and teeth will develop to the best condition allowed by the inherited factors. That condition must be considered the normal for that particular patient although it may not approach very closely to our ideal pattern. Any attempt

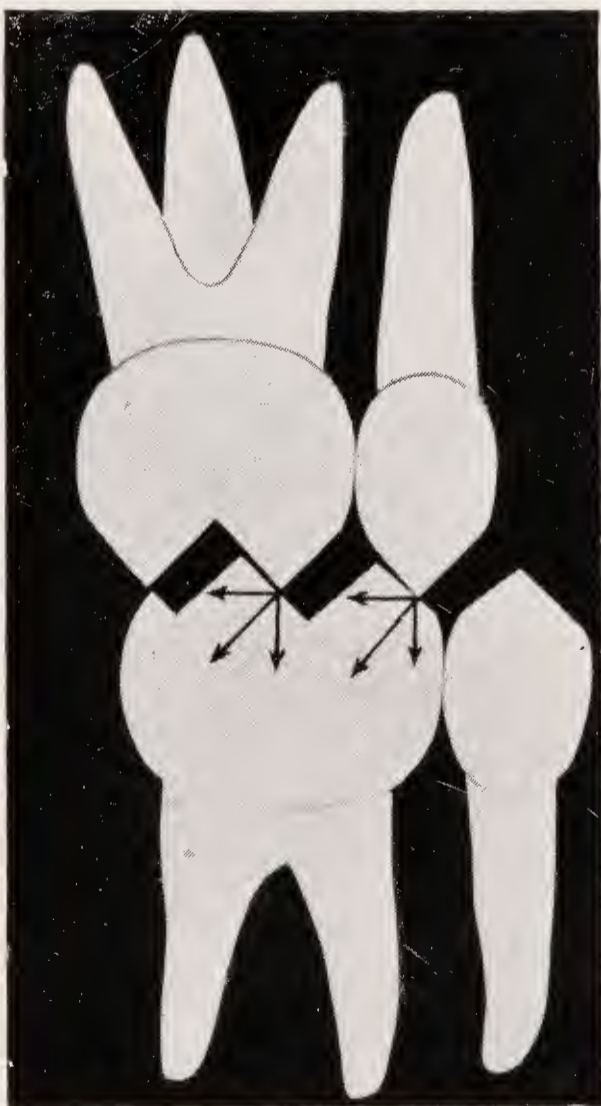


Fig. 1



Fig. 2

to alter that condition must be an adaptation. Some of these adaptations will remain stable if the tissues can adapt themselves to them and remain in a state of equilibrium. If they cannot do so then there will always be a relapse until a position of equilibrium is found. This position may, or may not, be the original one.

In these terms the endeavours of orthodontists are clear.

- (1) To prevent as far as possible the occurrence of unfavourable environmental factors.
- (2) To correct or eliminate them as soon as they appear.
- (3) To correct the results of them if possible.

By these means the inherited conditions are given the fullest possible chance to go ahead along the right lines. In those cases where there is a deviation in the patient's normal from accepted standards we endeavour to produce an artificial condition which is more in keeping with ideal standards of appearance and function, and which will be in equilibrium.

In considering what is the right track in the case of the over-bite and height of the bite we must first of all discuss what normal variations and changes occur during the process of the development of occlusion.

When the deciduous incisors first erupt they may show up to complete overlap when the jaws are occluded. With the eruption of the deciduous molars there is an increase in the alveolar height which prevents the complete overlap and the overbite is reduced.

As the patient grows older the overbite is reduced completely to an edge-to-edge condition by the wearing down of the teeth. This is a necessary condition to allow the forward movement of the lower jaw which should take place at this stage.

With the eruption of the permanent incisors there may again be an increased overbite which again is reduced by an increase of the alveolar height which takes place with, and following, the eruption of the premolars and molars.

As age increases function wears away the incisors until in old age the overbite is reduced completely, once more, to an edge-to-edge condition. Concurrently with the increase in alveolar height, there is an increase in the height of the vertical ramus of the mandible which keeps in step with alveolar and maxillary growth.

If we now consider the factors involved in the maintenance of the height of the bite and of the overbite I consider that they must be maintained by a balance of forces, some of which tend to increase them, and some of which tend to decrease them.

The factor concerned in the attempt to close the bite is the muscular force which is exerted through the opposing teeth every time the jaws are occluded in function. These muscles are not only in action when chewing but innumerable times through the course of the day when we involuntarily swallow.

The vertical depressing action of these muscles on the posterior teeth is obvious when we consider the act of closing the jaws in central occlusion ; but because of the inclined planes of the teeth there is also a vertical component of pressure every time lateral and forward movements of the mandible take place (Fig. 1).

I believe that these forward and lateral movements are particularly important in the maintenance of the overbite. Because of the inclination of the lingual surfaces of the upper incisors there is an upward and forward thrust on the upper anterior teeth when the

lower incisors meet them, and an equal downwards and lingual thrust on the lower incisors from the reaction (Fig. 2). The forward movement of the upper teeth is balanced by the continuous pressure of the upper lip, and the lingual movement of the lower teeth is balanced by the thrust of the tongue and also by the support of the contiguous teeth in the lower arch. The resultants, the upward pressure on the uppers and the downward pressure on the lower remain.

These must be some force which counteracts the depressing action of the muscles of mastication and this must be a power of growth of the alveolus. This power of growth decreases with age, but it is compensated for by a change in the character of the alveolus which becomes denser.

That this power does exist is shown when the depressing force is withheld by extraction of opposing teeth. The unopposed teeth elongate by an increase in the alveolar height. This occurs both in the deciduous dentition and in the permanent. A similar effect is shown in cases where there is a poor muscle tone—often mental cases—where the patient habitually goes around with his mouth open, the muscle tone is not enough to counteract the effect of gravity. These cases frequently show an open bite from elongation of the posterior alveolar segments (Fig. 3).

The height of the bite and the overbite are maintained by the balance of the muscular forces which are called into play in function, and the power of growth of the alveolus. Normal function in forward and lateral excursions of the mandible combined with normal function of the lip and tongue are required to keep the degree of overbite correct.

Closed bite occurs when the depressing forces are greater than the forces keeping open the bite, and affect the posterior segments of the alveolus. Deep overbite is that condition where the overlap of the incisors is greater than normal. Both conditions, in close-bite and deep overbite, may occur together. The British terminology would consider the close-bite due to lack of growth of posterior segments to be primary close-bite, and the deep over-bite a secondary close-bite.

An interesting example of the effect of increasing the pressure, or rather of supplementing the pressure, of the muscles of mastication is shown in a case of a patient who had been wearing a Potts frame for a tubercular spine for a long period of time.

I am told that in order completely to prevent any movement of the spine the patient's head was tied up tightly with a bandage and it was only loosened at meal times. The closeness of the bite is apparent, and the lower incisor marking the palate deeply, and the one incisor which escaped pressure is very much longer than the others.

So far I have considered the height of the bite when the teeth are in occlusion ; but when the jaws are at rest the teeth are always separated. The position of rest, with the teeth slightly separated, is maintained by the tone of the muscles, the counteraction of the muscles closing the mouth against the infrahyoid group of depressor muscles and the pull of gravity on the mandible. If individual muscle length is a fixed quantity beyond our control, which I believe it is, it follows that provided the muscular tone is good then this rest position of the mandible is also a constant for any

*Fig. 3**Fig. 4*

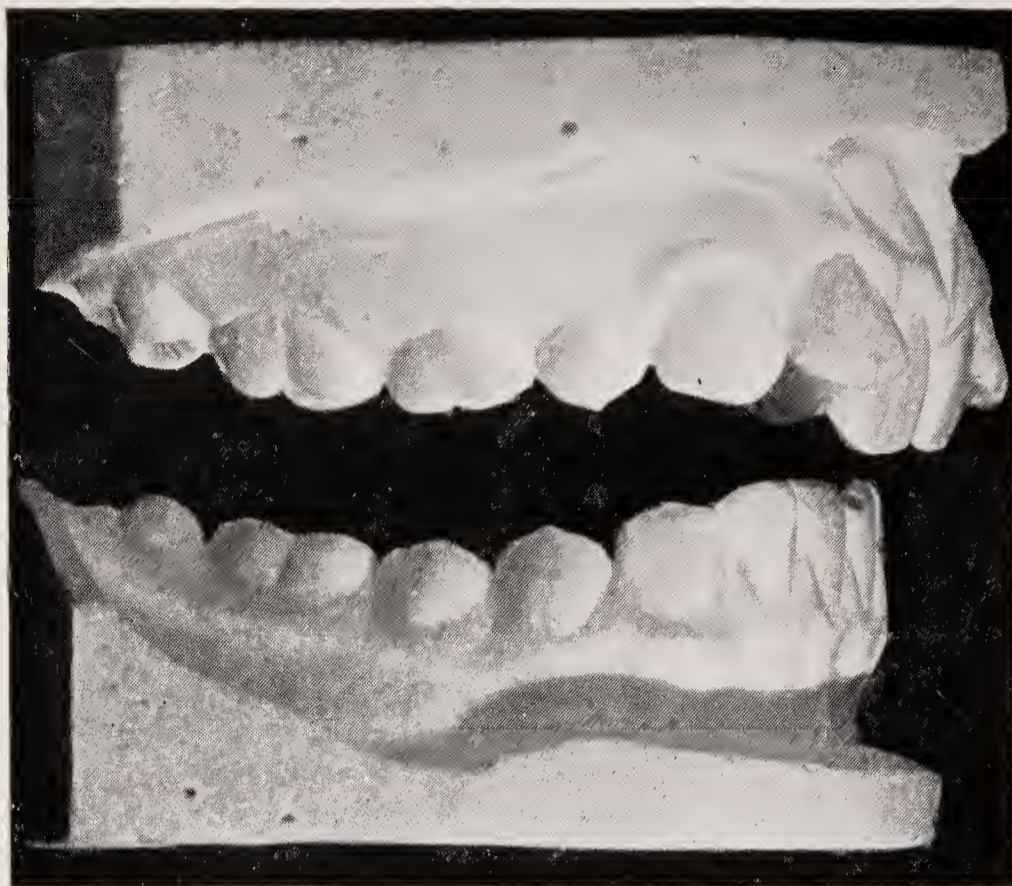


Fig. 5

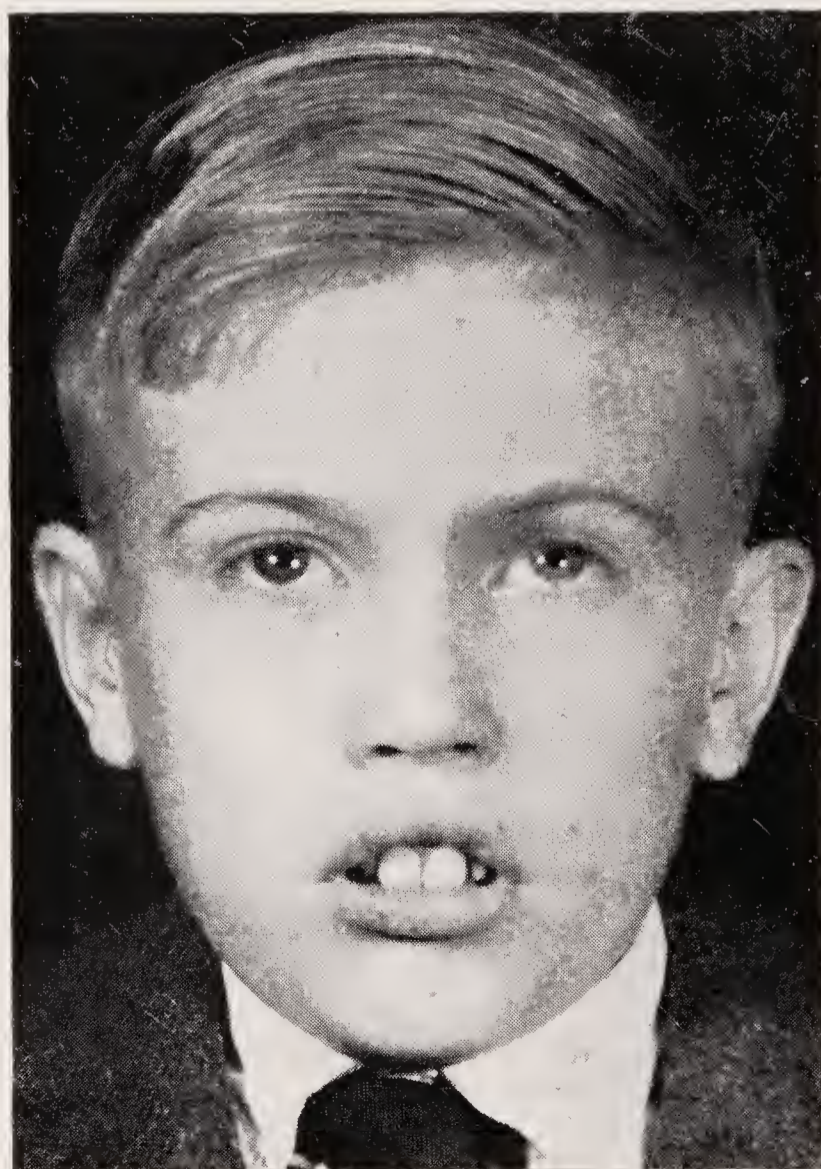


Fig. 6

individual patient, and also beyond our control. An interesting series of cephalometric measurements by Thompson over eight years showed a variation of less than 1% in the nasal length to total heights when the measurements were taken with the mandible in the rest position.

His investigations on adult patients showed that it was impossible to open the bite more than was allowed by the rest position of the mandible. This included a normal space between the teeth—the physiological rest space—which he called the free-way space. Any attempt to open the bite further invariably resulted in a depression of the teeth, if overlays were used, or an absorption of the alveolus if dentures were used, until the rest position and the free-way space were re-established.

He agreed that an abnormally large free-way space can be found in some patients and it is that condition which we call primary close-bite. He further stated that our treatment of a closed bite condition is merely to fill in the abnormally large free-way space and reduce it to normal proportions, but he did not indicate why when we do close it in the space should remain closed and not just open up again.

If I may return to an earlier observation, the condition of a close-bite, or a large free-way space remains as it is because the forces involved are in equilibrium. It is not sufficient to move the teeth to another position and expect them to stay there without relapse unless they are in a new position of equilibrium. This means that we have to alter the balance of the forces, either by reducing the muscular pressure exerted in function, or increasing the opposing force.

Reduction of the muscular power is a most unlikely thing to happen and I fail to see how we can influence the power of growth of the alveolus, and I am forced to the conclusion that the only way by which we can alter the balance of forces is by removing restrictions on the power of growth and allowing it fuller expression.

Another explanation has been given as to why bites which have been opened remain so, and this is that at maturity a more normal metabolism is established. That is to say that a change in the condition of the bone is likely to occur at maturity.

An important factor is the eruption of the second permanent molars and they make a very considerable contribution to the forces opposing the muscles of mastication. Later on with the eruption of the third molars the balance is again tipped in favour of the forces opening the bite.

I should like to mention some experiments that have been carried out by Breitner on monkeys. After using bite plates he showed that changes had occurred at the temporo-mandibular joint, and at the angle of the jaws and also in the alveolus. These changes one would expect, but there was nothing to indicate that they should remain as a permanent change when the appliance was removed unless the change at the angle of the jaw indicated a change in muscular attachments to bring about a change in equilibrium.

Bahador and Higley have done a series of experiments using lateral radiographs for measurement purposes. They showed that after raising the bite that there was an increase in the total face height in all cases, an increase in the posterior dental height in

all cases, and very little change in the position of the mandibular incisors. Various other investigators have also demonstrated that little change in the incisor height occurs when the bite is raised.

Turning now to the classifications of close-bite, I am dividing them into primary close-bite, in which there is a definite lack in lower face height, and secondary close-bite, in which the lower face height is normal but there is still an abnormally large over-bite. There are disadvantages in all classifications and I am alive to the faults of this one.

Primary close-bite. The ætiology of some of these is fairly clear while others are obscure.

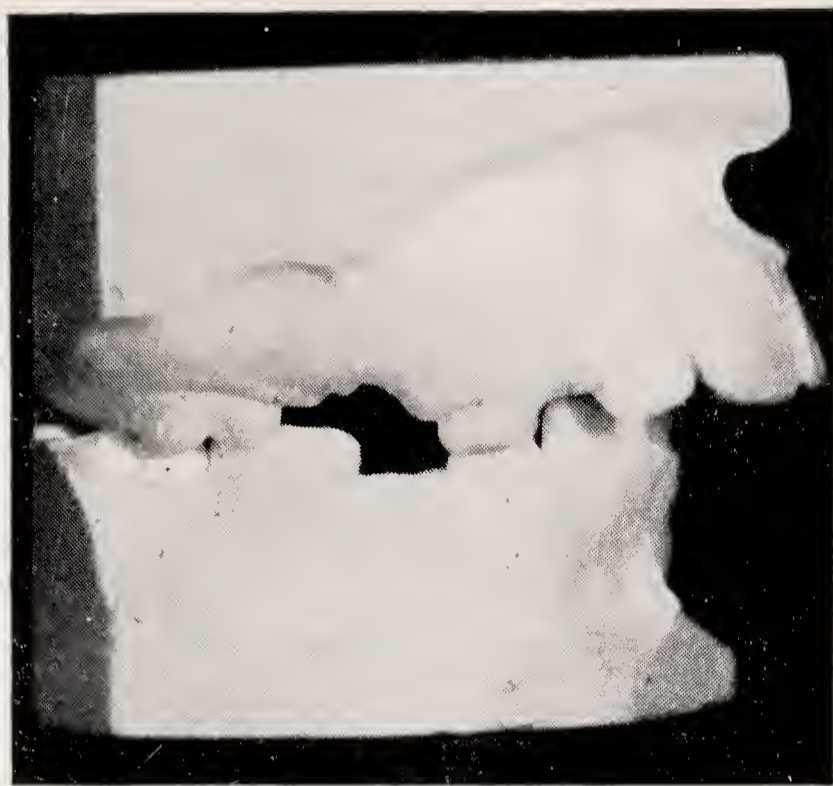
- (1) Where there has been a loss of a large number of teeth i.e. an elimination of the growth power of a large part of the alveolus, the remaining teeth being depressed. Some of these will recover of their own accord as the permanent teeth erupt, but some may not do so unless a bite plate is used (Fig. 4).
- (2) Where, e.g., the muscular power has been reinforced as in the example I showed before.
- (3) In some cases owing to the axial inclination of teeth other teeth are locked between them and prevented from erupting properly. These have been described by Hemley in Class II, Div. II types of cases where the lower premolars have been locked by the inclination of the axes of the first molar and canine. The correction of these axial inclinations allows the premolars to erupt and to take their full part in opposing the muscular power (Fig. 5). In all cases of close-bite there is a limitation of function, antero-posterior excursions of the mandible are inhibited, or at least very much restricted. The only other suggestion that I can make why some bites remain open when treated is that the change in occlusal relationship allows of more normal function and that by bringing additional anteriors into play the effective force opposing the muscles is increased.
- (4) Cases of lack of lower face height which are inherited.

Secondary close-bites. An abnormal over-bite not associated with lack of face height.

An important consideration is the factors influencing the position of teeth in the arches. During the development of occlusion there is a continual forward pressure being exerted on teeth by the development of teeth behind. This pressure is transmitted by the contact points of the teeth and subject to the limitation of the apical bases the tongue, the cheeks, and the lips act as guides and by exerting pressure on the teeth keep them in the arches.

The forward thrust is most likely related to the amount of growth of the jaws. In cases where this growth is adequate there is ample room for the teeth and the forward thrust is lessened. On the other hand where the development is poor the forward thrust is probably greater and accommodation must take place in some way, either by buckling of the arches, or by impaction of the molars.

I think it is important to remember that the lips counteract not only the pressure of the tongue but also the forward thrust from behind. One other important fact is that because the upper teeth are external to the lower—the lower arch acts as a splint to the upper arch and this is particularly important in the anterior region.

*Fig. 7*

The result of breaking the continuity of the lower arch near the front of the mouth, in particular, upsets the antero-posterior equilibrium and the part in front of the break is either prevented from developing forwards or in some cases the teeth are tilted lingually. The upper teeth, provided the lip position remains good, are also tilted lingually and a close-bite—a secondary close-bite—results from the tilting. If the lower lip gets underneath the upper incisors they are forced outwards and there is additional pressure put upon the lowers to give them a further inclination lingually. The lower incisors are deprived of their normal antagonists and grow upwards until they meet some resistance—the palate.

I think the importance of a complete lower arch in the prevention of close-bite cannot be overstressed. We are very frequently put into the position where, because of the premature loss of deciduous teeth or because the apical bases are too small, we have to extract permanent teeth. In these cases I feel confident that the best results would be obtained by removing the second permanent molars, and by moving the remaining teeth backwards in order to accommodate them to the apical base rather than to remove premolars.

A lack of tone, or bad lip position of the upper lip upsets the A/P equilibrium in the upper jaw tending to allow the whole of the upper teeth to migrate forwards. The lips do not keep the upper incisors pressed back against the lower teeth, and again a close-bite results from an over-growth of the anterior segments (Figs. 6 and 7).

While it is important to recognise that a close-bite may be a developmental phase and that as the patient grows older the condition may restore itself, there is a certain danger unless it is also recognised that a close-bite at certain stages of development is definitely wrong. At the completion of the deciduous dentition a close-bite means that the lower jaw cannot move forward as it should and treatment is indicated to make that possible.

To sum up. The height of the bite is maintained by a balance of forces exerting the muscles of mastication against the power of growth of the alveolus. A permanent change in the occlusal level

can only be effected by an alteration of this equilibrium. The most likely way to change the equilibrium is to bring into play more of the available growth force of the alveolus, either by erupting more teeth, or to utilise the ones which are there to better advantage. The limitation imposed by inheritance must always be borne in mind.

DISCUSSION

The President said that they had had an extremely good paper from Mr. Softley, who was a newcomer to them, but obviously an old hand at lecturing. His material was of great interest, and he supposed that there was not one of them who would not be attracted by his methods of dealing with close bite as against the methods which had been formalized.

Miss L. Clinch said that she was not entirely conversant with Mr. Softley's idea of removing the second molar and moving the teeth backwards ; she had not had a great deal of experience of it. He had mentioned that the pressure from the cheek was one of the forces used in this equilibrium, but actually she had always understood that the cheeks were, as it were, curtains to the arch and did not exert pressure.

Miss C. Smyth thanked Mr. Softley for the emphasis he had laid on the importance of keeping the lower arch intact where it was reasonably possible to do so. She thought that was one of the most important things which should be impressed on all orthodontists at every possible opportunity. In view of the importance he had laid on this in the latter part of his paper she would like to take him up on the earlier part. Speaking of the close bite due to the loss of the upper deciduous molars, he had said that it would have been just as good if the patient had lost the lowers as well. But it seemed to her that if the lowers were lost a certain amount of power of mastication would be lost. Even if there was a space in the upper jaw, food was masticated to a certain extent by the lower teeth.

Mr. C. F. Ballard congratulated Mr. Softley on his contribution to a subject which had needed clarifying for a long time. In this country the term "close bite" had been used far too loosely. Mr. Softley had rather taken the wind out of his sails because he himself was bringing these points together in a paper and attempting to prove them by showing the change of inclination of the teeth following the early loss of the deciduous teeth and the correction. He had in mind the angle of inclination in identical twins—or not quite identical because in one there had been an early loss of deciduous teeth in the lower jaw. In the one case there was a natural inclination of the lower incisor of 92 deg., and in the other twin—the one with early loss of deciduous teeth—the lower incisor had dropped back to 86.5 deg. That was an explanation of close bite after early loss ; the natural inclination was changed. The treatment was to bring back the upper incisor without raising the bite.

Professor M. Rushton said that he remembered studying two cases of children who had lost their upper lips at an early age as a result of burns. Those children did not show forward migration or inclination of their upper teeth, and therefore he was not convinced that, although the pressure on the upper teeth might be desirable, it was absolutely essential if other conditions were healthy.

Miss R. Caseley felt that in the classification of over bite, which Mr. Softley had called secondary close bite, he had not associated it enough with the postnormal mandible. She had been particularly interested in the slide he showed in which by dealing, she thought, with the lower six, he got further eruption. She thought that in this particular case, if the incisor had been advanced the mandible would have had freedom to come forward.

Mr. J. W. Softley, in replying on the discussion, said with reference to the extraction of the lower sevens, he had not had a great deal of experience of it, but from the theoretical point of view he thought it was what they ought to aim at, and at the moment he was trying to devise a good way of moving the sixes to include the lower fours and fives. He thought that was the answer to many of their problems.

Miss Smyth had commented on one of the slides where there was a close bite due to the loss of upper deciduous molars. He agreed with what she had said about the loss of the lowers ; he had been thinking purely from the point of view that the pressure of the uppers against the lowers had been lost. From that point of view it did not matter much if the lowers had been lost, but from the other point of view from which Miss Smyth had spoken he was in entire agreement.

Mr. Ballard had mentioned the inclination of the lower incisors. He (Mr. Softley) was not suggesting that the proper treatment for these cases was to put in a bite plate.

In reply to Prof. Rushton he could only say that these patients were extremely well developed.

Miss Caseley had brought in the post-normal mandible, but he demurred at bringing post-normal mandibles into the discussion.

On the motion of the President a vote of thanks was accorded to Mr. Watkin for his Short Communication and to Mr. Softley for his paper.



THE PRESIDENT'S VALEDICTORY ADDRESS

Mr. Robert Cutler said that this brought them to the conclusion of their meeting, and the time for him to bid them farewell. The year had been a successful one, if increase of membership was any criterion, but what was more noteworthy was the great increase in average attendance at meetings, which spoke well for the excellence of their programme and those who had contributed to it, though indeed this very success placed added responsibility on the Council for next year, so that members might be even further stimulated and encouraged.

It seemed a long time now since their demonstration meeting on that warm May evening in 1945 when there were flags flying and cheering in the streets, and now a winter of weariness and disillusion had them all in its grip. As was so often the case, the fruits of victory had turned bitter in the mouths of the conquerors, and most of them knew well enough that the climacteric of their national distress had not yet been reached, so that it was perhaps all the more credit to members that in the midst of such manifold pre-occupations they had had time to give such support to the Society's affairs.

Later there would be an official vote of thanks to the Council and officers, but in advance and apart from it he desired to express his own thanks, firstly to Mr. Chapman, who after so many years of arduous Council activity, continued as Hon. Treasurer, managing their financial affairs with that housewifely discretion which was so essential; and, secondly, to their good Secretary, Kenneth Pringle, and their excellent acting secretary, Gordon Taylor, whose work had been supremely good. Of the ideal secretary they asked three things: first, that he should act in an impersonal stooge-like capacity, taking diligent note of Council proceedings, and acting on its instructions; secondly, that he should possess a superabundance of tact and worldly urbanity, successfully to prosecute their business with outside bodies, and to calm the surface of the Council sea when it became ruffled by passing storms, and thirdly, that he should be, or become, a strong member of Council in his own right, lending the full weight of his experience to the Council's collective decisions. In all those qualities both Pringle and Taylor had excelled, and they were grateful to them and confirmed in the wisdom of their choice.

It was, of course, true that after a period of years secretaries tended to develop a disease, akin to a virulent megalomania, in the grip of which they often managed the whole of the Society affairs without reference to the Council, much less its President, and some of them might recall that their last Secretary was felt by some to have suffered acutely from this condition*. For this, however, the Council had a certain cure, and that was to elevate the patient to the Presidential Chair, where, after a brief flash of meteoric activity he vanished for ever from the scene. That was his own fate that evening.

In addition, he had to thank all of them for the respect and kindly patience they had at all times accorded him. The respect, he knew, was towards the office he had held ; the patience and courtesy he took as a mark of their kindliness to him personally, and for this he offered his best thanks. Having for so long been associated with the active prosecution of the Society's affairs, this moment of farewell gave him a strange feeling, as if he had been suddenly transmuted from one of the dancing figures in a brightly-lit Edwardian ballroom and had become one of the ancestors on the balcony above, where in wooden frame, and under the cracked and peeling varnish of the canvas he would for ever thenceforth look down with fixed and disapproving stare on the scene of love and laughter below. It was, he thought, Somerset Maugham who talked of the bitterness of an aim achieved, but he asked them to believe him that when first elected to serve the Society as its secretary so many years ago, it never entered his head that he would become its President, and now the interlude was over, and by tradition he remained as an elder statesman, perhaps not old enough or wise enough to be a real Samurai, and certainly the least dignified of them all.

*Some newly joined members of the Society may not know that Mr. Cutler was here referring to himself.



INDUCTION OF THE NEW PRESIDENT

Mr. Cutler then turned to his last duty, which was to introduce the new President, Martin Rushton, whose nomination by the Council the members had so wisely confirmed that day. Many of them would remember his father, William Rushton, himself a past President, for whose monument they had only to look in past copies of the Transactions for the many papers he gave them, all full of practical wisdom, and as valuable to read today as when first written. He remembered well enough his son Martin coming from the 'Varsity to join them at Guy's, and even then he manifested a magnificent disdain for the more plumbing aspects of dentistry at which so many of them laboured, perhaps not ineffectually, today. His career, both in the peace and war years, had very fortunately given him scope to develop his particular talent of which the profession was in great need at the present time, and he did not doubt that his knowledge and authority and the respect and recognition so widely accorded to him would stand the Society in good stead in the coming year.

He therefore introduced Martin Rushton, distinguished son of an illustrious father, Master of Arts, Doctor of Medicine of Cambridge, Professor of Dental Medicine at Guy's Hospital, and asked him to accept the seal of office from him and to conduct the remainder of the business that evening. And so he bade his fellow members and friends good-bye.

Prof. Martin Rushton, on taking the Chair, thanked Mr. Cutler for his kind words, and said with what humility he followed him.

VOTE OF THANKS.

Mr. J. A. Hudson proposed a vote of thanks to the retiring President. He said that Robert Cutler was one of the best known amongst them. During his long tenure of office as Hon. Secretary he devoted himself tirelessly and with great distinction to the work of the Society. They would long remember him for the work he did year after year, together with his personal contributions, his papers, and his Presidential Address. Scientifically minded and a craftsman in orthodontics of a high order, he had gained the respect of all members of the Society. During the past year in the presidential chair his personality had shown itself in the conduct of the meetings and in many other directions. They trusted that he had enjoyed his year of office as much as they had enjoyed seeing him in that high seat.

The vote of thanks was accorded by acclamation.

Mr. Trevor Johnson proposed a further vote of thanks to the Officers and Council. He felt that they had given to the work of the Society much more than usual attention. The year had meant greatly increased secretarial work. They were specially grateful to Mr. Gordon Taylor, who had acted in Mr. Pringle's absence, to Mr. Chapman for his management of the finances and the way he had brought about the raising of the subscription, and to the librarian and the curator, whose work had been extremely valuable. The editor, as they had heard had had a difficult time over the Transactions, and they were glad that now satisfactory arrangement for the future had been made.

This resolution also was carried by acclamation.

The President added a word of thanks to the lanternist for his efficient service. He then announced that at the next meeting, on January 12th, 1948, he would deliver his Presidential Address.

The meeting concluded.



REPORTS OF MEETINGS

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, January 6th, 1947, at 8 p.m. The President, Mr. R. Cutler, occupied the Chair.

The Minutes of the last Ordinary Meeting, held on December 2nd, 1946, were read and were confirmed and signed.

The President, in welcoming the visitors who were present, said that they included Miss Mildred Wenyon, the Secretary of the Royal Society of Tropical Medicine, the landlords of the British Society for the Study of Orthodontics, whose members looked upon Miss Wenyon as their very "kind landlady." There were also present as visitors Miss Wilson, who had for long been editor of the *Dental Record* and who had done much for the Society during the war, and Miss Joan Bright, a friend of his own, who had been Secretary of the War Cabinet Office during the war and had been present at almost all the meetings between Mr. Churchill, Mr. Roosevelt and Marshal Stalin.

He had received a long letter from Mr. Badcock, the first President of the Society, who was unable to be present that evening. He was over 80 years of age and lived twelve miles from a station.* In the letter Mr. Badcock paid a tribute to the late Dr. Northcroft. The letter was amongst the documents exhibited at the present meeting, and he proposed to read it at the Northcroft Memorial Lecture later in the year, because Mr. Badcock's tribute was such a genuine and kindly one and would be very appropriate on that occasion.

The following newly elected members were introduced to the President and, having signed the Obligation Book and given an undertaking to observe the obligation set out in Rule 7, were admitted by the President to membership of the Society: Mr. Ian M. Chisholm, Mr. Thomas McNamara and Mr. Edward Stuart Smith.

The President announced that at the last meeting of the Society, Mr. Boness and Mr. Newton had been re-elected as Honorary Auditors and both of them had signified their willingness to continue in that position for another year. Now that the Society employed professional auditors, the technical responsibilities of the Honorary Auditors were less, but their advice was very welcome to the Society, particularly in the present difficult times.

He would be glad if those members who did not already pay their subscriptions to the Society by banker's order would begin to do so now. The Honorary Treasurer, Mr. Chapman, would send them, on request, a form for the purpose. He hoped that any members who did not wish to adopt that method of payment would send in their subscriptions as soon as possible, thus lessening the work which the Honorary Treasurer had to do.

If any of the members had any models or other articles of interest which they were willing to give to the Society, he would be glad if

*See report of Meeting 6th October.

they would send them to the Curator, Miss Clinch, at 27, Wimpole Street.

The Librarian, Mr. Gordon Taylor, 51, North End House, Fitzjames Avenue, W. 14, would help any members with regard to the loan of books. All other matters should be referred to the Secretary.

The meetings of the Society were reported regularly in the *Dental Record*, the annual subscription to which was £1 . 1 . 0. The *Dental Record* contained much matter that was of interest to orthodontists. There had been considerable delay in the publication of the Society's Transactions for 1944, 1945 and 1946, but that matter was having attention.

In the pressure of business at the last meeting of the Society, Mr. Pringle's appointment as Assistant Dental Surgeon to the Dental Department of Guy's Hospital had not been mentioned. He was sure that everyone present would like to congratulate Mr. Pringle on that signal honour. (*Applause.*)

The following candidates for membership of the Society were elected *en bloc* by show of hands:—

Charles F. H. Bulow, 20, Cedar Road, Sutton, Surrey ;
James H. Gardiner, 4, Albert Road, Hale, Altrincham, Cheshire ;
Frank K. Johnson, 3, Park Crescent, Portland Place, W.1 ;
Hugh V. G. Tredgold, 12, Oxford Street, Nottingham ;
William H. Ellam, Golberdon, Callington, Cornwall ;
Ronald V. Shepperd, Dunheved, Pilgrim's Way, West Humble, Dorking.

Mr. R. E. Rix (Immediate Past President), in presenting a cheque to the President, said that many of the members had wished for an opportunity to show their appreciation of and gratitude for the fifteen years' service which Mr. Cutler had given to the Society in the capacity of Honorary Secretary. That length of service was unique in the annals of the Society, and during the whole of the time the Society's interests had been protected and fostered by Mr. Cutler. Personally, he could remember Mr. Cutler being elected as Honorary Secretary in 1931 and at once embarking upon his duties as to the manner born. The Society had thus gained as its Secretary both an enthusiastic orthodontist and a forceful personality. He himself had been a member of the Council long enough to know how pervading and time-consuming Mr. Cutler's efforts had been, and the Society owed him a debt which it could never repay. On behalf of very many well-wishers, he asked Mr. Cutler to accept a modest token of their sincere appreciation and thanks. They were delighted to have him as their President, and they trusted that he would have a successful year of office and, in the larger sphere of life, continued prosperity.

The President, in thanking the members for their gift, said that in the early days of his secretaryship of the Society he had received untold encouragement and support from the previous Secretary, Mr. Leslie Packham, and in the later years, particularly the war years, when tempers were strained and matters were difficult, his colleagues on the Council had treated him with marked courtesy and forbearance.

Having been Secretary for so long, he had thought that he knew all that was going on in the Society and, after he ceased to be Secretary, he had still been under that impression, but he had known nothing about the very kind gift which had just been made to him until he had received the following letter from a member of the Society: "Dear Robert, So glad to hear about presentation, after your fifteen years as Secretary, which term must have seemed as long to your fellow-members as it did to you. I have sent a donation and have received a receipt which is No. 20, so that there should be at least £1 in the kitty when the presentation is made." On looking at the cheque, he saw that the amount was very much more than £1, and there were also some dollar bills which had not been surrendered to the Treasury, as they should have been. He did not know how they had arrived, but he was afraid that it must have been by some illegal means.

He sincerely thanked the members for their gift. It was a disarming gift, and he felt that in future his remarks would make up in politeness for what they lacked in profundity.

The President then delivered the following Presidential Address:—

"LET US LOOK BACK"

A Review of the personalities, and activities of our
Society since its inception in 1907

VOTE OF THANKS

Mr. L. Russell Marsh, in proposing a vote of thanks to the President for his Address and congratulating him upon it, said that there could be no better indication of the President's interest in and devotion to the Society than the exposition he had given that evening. The work involved in its preparation, which apparently had given Mr. Cutler great pleasure, could not have been undertaken by anyone who was not keenly interested in the Society's affairs. As far as the older members were concerned, the Address had stirred very deep chords of memory, some sad and some very happy. It was a pleasure to hear mentioned in the Address the names of Northcroft, Badcock, Cale Matthews, Schelling and others to whom the Society owed so much.

He was sure that everyone present would wish to congratulate the President on his Address. If it was a sample of the service which members were to receive from Mr. Cutler during his year of office, they would be well content.

Mr. C. L. Endicott, in seconding the motion, said he was sure that the President's selection of the outstanding contributions made to the Society's Transactions would be of very great help to all members, particularly the younger members.

The vote of thanks was accorded with acclamation, and the meeting then terminated.

ORDINARY MEETING

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, February 3rd, 1947, at 8 p.m. Mr. Robert Cutler, President, occupied the Chair.

The Minutes of the last Ordinary Meeting of the Society, held on January 6th, 1947, were read and were confirmed and signed.

The President welcomed the many visitors who were present and invited them to take part in the discussion. He hoped that they would find the proceedings so interesting that they would come to many future meetings of the Society and eventually become members thereof.

The following recently elected members signed the Obligation Book and were introduced to the President: Mr. Joseph Angelman, Mr. Charles F. H. Bulow, Mrs. Muriel E. H. Davis, Mr. J. H. Gardiner, Mr. T. Cradock Henry, Mr. A. Maxwell Horsnell, Mr. F. K. Johnson, Mr. M. A. Kettle, Mr. A. Kinghorn, Mr. E. W. Pedley, Miss J. G. Ritchie and Mr. T. C. White.

The following candidates for membership of the Society were elected *en bloc* by show of hands:—Margaret N. Miller, 13, Inverleith Place, Edinburgh, Ilja Frischmann, 47, Peartree Road, Enfield, Middlesex, Louis C. Mandeville, 79, Eastcote Road, Ruislip, Middlesex, Douglas Munns, 44, Blackwater Road, Eastbourne, Sussex, William G. Godrey, Buckingham House, Graham Road, Malvern, Worcs., Derek J. Wigginton, M.B.E., 216, Court Road, S.E.9.

The President, referring to the symposium of papers on the Norwegian system which were to be read by Messrs. Endicott, Pedley and Grossmann, said that orthodontists had heard something about that system before the war, when it was popularised—though he believed not originated—by Andresen. During the war they had not heard much about it until towards the end of the war, when Mr. O. Henry and Mr. Russell Marsh had made some reference to it. As a result of that, Mr. Endicott had been asked to demonstrate the system at the Demonstration Meeting in May last year, and he had given a very valuable and authoritative demonstration, from which had arisen the request that he would give a paper on the same subject. The members would like to hear from Mr. Endicott and his colleagues something of the rationale underlying the system, the conditions under which it could be used with a reasonable prospect of success, and the appliances used and the methods of adjusting and maintaining them in use.

The following papers were then read:—

“ PRACTICAL AND THEORETICAL OBSERVATIONS ON THE
NORWEGIAN SYSTEM ”

By G. L. C. Endicott, W. Grossman and V. G. Pedley.

On the motion of **The President**, a vote of thanks was accorded to the authors of the papers, and the meeting then terminated.

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1. on Monday, 3rd March, 1947. The President, Mr. R. Cutler, occupied the Chair.

The Minutes of the Meeting of 3rd February, 1947, were read, confirmed and signed.

The following new members were introduced to the President and signed the Obligation Book: Messrs. D. J. Wigginton, Douglas Munns, and N. F. Clarke.

The following candidates for membership of the Society were elected *en bloc*, by show of hands: Harry D. Bliss, 11, The Mead, Beckenham, Kent, Peter Felix, L.D.S., 23, Old Manor Court, Abbey Road, N.W.8., John G. Hancock, B.D.S., 19, Harcourt House, 19, Cavendish Square, W.1., Donald A. Rogers, L.D.S., 24, Manor Park Crescent, Edgware, Middlesex, Howard Shaw, L.D.S., 53, Gledhow Wood Grove, Leeds, 8, Kurt Strauss, 107, Deansbrook Road, Edgware, Middlesex, Norman Wild, L.D.S., 370, Hollins Road, Oldham, Lancs.

The President then invited Mr. W. Trevor Johnson to give his Casual Communication: "A Case of Asymmetry Associated with Difficult Labour" and "The 'immediate' Construction of a Thumb Guard." These communications were followed by a Paper by Mr. B. R. Townend on: "The Philosophy of Orthodontics"

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, April 14th, 1947, at 8 p.m. Mr. R. Cutler, President, occupied the Chair.

The Minutes of the Ordinary Meeting held on Monday, March 3rd, 1947, were read and were confirmed and signed.

The President announced with great regret the death of Mr. G. W. Royle of Goldington Road, Bedford, who had been a member of the Society for very many years, although latterly he had not often been present at its meetings. The Secretary had been instructed to write a suitable letter to Mr. Royle's widow.

At the request of the President, the members stood in silence for a few moments.

The President welcomed the many visitors who were present and invited them to take part in any discussions that might arise. He hoped that if they found the meeting enjoyable they would attend future meetings of the Society.

The following recently elected members were introduced to the President and signed the Obligation Book: Mr. M. D. Bliss, Mr. Ilja Frischmann, Miss Rachel Mears and Mr. Kurt Strauss.

The following candidates for membership of the Society, who had been approved by the Council, were elected *en bloc* by show of hands:—Sydney Bourne, M.B., Ch.B., L.D.S., 49, Daisy Bank Road, Victoria Park, Manchester, 14; Alexander Buchan, L.C.R.P. & S., L.D.S., 117, Newlands Road, Tunbridge Wells; Patrick D. O'Connor, L.D.S., 126, The Drive, Hounslow; Basil W. Pett, B.D.S., 22, Wimpole Street, W.1; Philip D. Priest, L.D.S., 325, Willow Road, Enfield; John A. G. Starnes, L.D.S., Dene Lodge, London Road, Guildford; Roy I. H. Whitlock, L.D.S., 18, Upper Wimpole Street, W.1; Herbert E. Wilson, L.D.S., 64, Warren Street, W.1.

The President, in introducing Miss Caseley, who was to read a casual communication, said that Miss Caseley had been a member of the Society for many years and attended its meetings regularly. She was very modest and did not often add her voice to the trumpetings of her more vociferous colleagues, so the members had all the more pleasure in hearing her on the present occasion.

The President then invited Miss Caseley to read her paper on: "The Principles and Construction of the Oral Screen as a Functional Appliance."

An Ordinary Meeting of the Society was held on Monday, May 5th, at 8 p.m. Minutes of the previous Meeting were read and confirmed.

DEMONSTRATION MEETING

The following is a summary of some of the demonstrations.

Miss M. STILL, L.D.S. (Eng.):—"Cases from the School Clinics."

Mr. J. S. BERESFORD, B.D.S., H.D.D.:—"Twin Arch Technique."

Mr. S. G. McCALLAN, L.D.S. (Eng.):—"Night-time Appliances."

Mr. H. C. VISICK, L.D.S. (Eng.):—" 'Press Button' Plate and Finger Springs."

Mr. J. W. SOFTLEY, B.D.S. (Liv.):—"The Split Arch Appliance."

Mr. W. GROSSMANN, M.D. (Prague), L.D.S. (Eng.):—"A Simple Orthodontic Model Former."

The following candidates for membership of the Society who had been approved by the Council, were elected. Adrian G. Batten, L.D.S., School Medical Department, Education Offices, Manchester 3, James Healy, L.D.S., 27, Weymouth Street, W.1., Donald E. Mason, L.D.S., 44, Trevor Road, W. Bridgford, Notts., Miss Dorothy S. Mountford, L.D.S., 14, Hollycroft Ave., N.W.3.

ORDINARY MEETING

An Ordinary Meeting of the Society was held at Manson House, Portland Place, following the Extraordinary General Meeting, on Monday, July 21, 1947. The President, Mr. Robert Cutler, was in the Chair.

The Minutes of the previous meeting were signed as correct.

Three new members were introduced by the President and signed the Obligation Book.

The Secretary read the names of candidates for election which appeared on the Agenda and these candidates were unanimously elected.

The Chairman, in introducing the speaker of the evening, Dr. Andrew Jackson of Philadelphia, said that Dr. Jackson's visit had been arranged and facilitated by their members, Mr. Russell Marsh and Mr. Kenneth Pringle. During the last eight or nine years they had been behind the orthodontic "iron curtain" particularly during the war period when the interchange of views and opinions with their colleagues abroad had been particularly difficult. That, of course, had prevented them from seeing hardly any of their colleagues and their literature reached them at irregular intervals. On one occasion at the height of the Battle of the Atlantic a parcel of American journals arrived, and some days later he had a visit for professional purposes from the Commodore of the convoy concerned. When he had concluded his treatment of him he pointed to the pile of books and expressed his thanks. The Commodore's reply was typically naval, "The journey took three weeks and I was on the bridge for a fortnight and lost 14 ships out of 30. I hope the books were worth all that." But even in peace-time visits from their colleagues abroad were far too infrequent. Dr. Andrew Jackson had come to talk to them on the art of orthodontic practice. Life was short and art was long, but they all knew well enough that to be a good orthodontist was to have a combination of several qualities, not only technical skill but a deep understanding of the psychology of children and parents, a good academic approach to the subject, the power of ruthless self-criticism, and a capacity for not being disappointed when things did not go well.

The following paper was then read by Dr. Andrew Jackson:—
"Orthodontics—It's Nature and Objectives."

ORDINARY MEETING

An Ordinary Meeting of the Society was held at Manson House, Portland Place, on Monday, October 6th, 1947, with **Mr. Robert Cutler**, the President, in the Chair.

OBITUARY

The President referred at the outset of the meeting to the passing of Sir Norman Bennett, one of the earliest members of the Society, whose work on orthodontics alone would take a whole meeting to describe, though most of it could be seen in the first volume of his monumental work, "The Science and Practice of Dental Surgery." He did much to analyse the causes of malocclusion and, characteristically, almost his first contribution was a challenge to the then accepted classification of occlusal relationship. He also worked on the post-occlusion problem and stimulated the Medical Research Council to devote some of the Dental Board grant to the investigation and subsequent publication of a report. No side of orthodontics was neglected by him, but he was particularly interested in the causes of malocclusion. His last paper read

before the Society was in 1931 and was on the "The Psychology of Orthodontic Treatment." To those of them now in middle age he was almost an institution in dentistry, and they honoured him in his passing as a professional gentleman and a pattern to which each one of them should aspire.

The members present stood in silence.

New members were introduced to the President and signed the Obligation Book and the following candidates for membership were elected: Vincent C. Carrington, L.D.S.Eng., (Nottingham); Arthur E. Parrott, L.D.S.Eng., (Taunton); John K. Steel, L.R.C.P., M.R.C.S., L.D.S.

A short Communication was given by Mr. W. Trevor Johnson on "Identical Twins with Upper Incisors locked Lingually."

The Northcroft Memorial lecture followed which was delivered by Professor J. E. Harris; "Factors Concerned in the Growth and Development of the Jaws and Teeth."

THE FIRST NORTHCROFT MEMORIAL LECTURE

The President, in introducing Professor Harris, said that with the passing of their Founder, Mr. Northcroft, the Council came together to decide in what way they might best commemorate his name, and amongst other things it was decided that they might each year or as often as was practicable have what they would call a Northcroft Memorial Lecture in which the President would draw the attention of new members to the work of the Founder and keep his memory alive, and at which a distinguished speaker of some eminence either in their own profession or in an allied one would give a lecture which would be of permanent record and enhance the Society's reputation, which was very close to Mr. Northcroft's heart.

At this first Northcroft Memorial Lecture it would have fallen to his lot to refresh the memory of older members and acquaint new ones with the life work and personality of their Founder. But it was their good fortune to have in their midst that evening the first President of the Society, Mr. J. H. Badcock, to whom in large part he would delegate this duty. Indeed, he was happy to do so as the occasion was unique. Many of them respected and revered the name of J. H. Badcock hardly less than that of the Founder, and certainly he could think of no-one more suitable for such a task that evening.

To some of them George Northcroft was but a name; to others he remained a vital personality, his opinion guiding their Society and establishing a tradition which they would do well to follow today. In his latter years he was a dignified and rather austere

figure, regarding with tolerance youngsters like themselves who barked puppy-wise at his heels, and yet, as they themselves grew older, they realised the worth and greatness of the man and the value of his labours.

To Northcroft dentistry was a vocation rather than an occupation and his death in harness with his faculties unimpaired was surely a merciful gift from his Maker which was well deserved. At long last he came to the dark river after a life well spent, and he was sure the trumpets sounded for him on the other side.

Mr. J. H. Badcock, who was heartily greeted, said that the President was kind enough to give him an invitation to come to their meeting on the occasion of his Presidential address, but at that time he was afraid of the inclemency of the weather and they would agree that it justified his fears. Now he had asked him again on this occasion, and he was particularly glad to come especially to the first of the lectures which they were dedicating to keep green the memory of their Founder. To those of them who knew George Northcroft words would be superfluous, but there were many younger men present who had not that advantage. George Northcroft was a many-sided man. His excellent taste was matched with masterly craftsmanship, shown alike in a dental restoration or in the making of the ivory gavel which he constructed, carved, and presented to the British Dental Association. Around it he carved the words, "Law, order, duty, restraint," virtues dear to his own heart.

He remembered that Northcroft told him that after he had begun to construct the gavel and had done a little work on it he took it to an ivory carver to be finished. The man looked at it and then looked at Northcroft and said, "Who has done this so far?" When Northcroft told him that he had done it, he said, "Very well, then you are able to do the rest," and Northcroft did it. He did many things well and some superlatively well. He was never content with less than the best and his best was very good indeed. He supposed that his outstanding characteristic was thoroughness, and no-one followed the exhortation of Ecclesiastes, "Whatsoever thy hand findeth to do, do it with thy might" more closely. Having once put his hand to the plough he never looked back, and the furrow he followed was always a straight one. He could tolerate nothing crooked of any kind. As an instance of his capacity for continuous and painstaking observation he might mention the fact that he took models of the teeth of his own children annually from infancy to adult life. The models were beautifully made and beautifully kept. That was an example of the sort of valuable scientific work that any one of them might perform if they only took the trouble.

When they looked into the history of dentistry they always applied, of course, to Mrs. Lilian Lindsay, and she told him that the first classification of the relation of the dental arches was made in 1844 by Carabelli who gave the following classes: Normal bite, edge to edge bite, over bite, backward bite, and cross bite. Mrs. Lindsay also told him that Charles Gaine of Bath published the first book on orthodontics in 1858-59 entitled, "*Certain irregularities of the teeth, with cases illustrative of a novel method of successful treatment*,"

Then in 1880 the American Council published a treatise on oral deformities as a branch of surgery, and later Angle published his classification, which imperfect as it was, always seemed to him to be the first to bring order out of chaos. But forty years ago the regulation of misplaced teeth was a haphazard affair and purely empirical. George Northcroft felt that a scientific basis was needed for the work, and one evening when they were talking "shop" together, as they often did, he suggested starting a society for the study of the subject. He did not know exactly why Northcroft spoke to him about it, except that it might have been that he (the speaker) had already given a course of lectures on this theme at Guy's. They approached other people—Rushton, Hopson, Schelling amongst them—and soon collected an enthusiastic nucleus for the new development, and so the B.S.S.O. was born. This infant Society had grown in knowledge and in stature and had more than justified the hopes of its parents. He trusted that it would continue to grow and live long to work for the advancement of knowledge with ever greater success in its application to practice.

The President said that Prof. J. E. Harris, who was to deliver the first Northcroft Lecture, and whose services had been secured for them by Mrs. Lindsay and Mr. Trevor Johnson, was an M.A. and a Doctor of Philosophy, Professor of Zoology in the University of Bristol, a Scholar of Christ Church, Cambridge, and he had been a Commonwealth Fund Fellow at Colombia University, U.S.A. He had written papers on various scientific subjects, and he had brought much scientific knowledge and experience to bear on the subjects about which he had written.

Prof. Harris had written his lecture in advance and it had been circulated to members. He understood that what he was going to say was something apart from this printed lecture, and a note would be taken of it and it would be added to the record.

ORDINARY MEETING

An Ordinary Meeting of the Society was held at Manson House, Portland Place, W.1, on Monday, November 3rd, 1947, with the President, **Mr. Robert Cutler**, in the Chair.

The following candidates were elected :

Ordinary Member

Miss E. M. Knowles, H.D.D., L.D.S., Ministry of Health, Whitehall, S.W.1.

Corresponding Members

F. J. Tessier, D.D.S., 314, State Street, Albany, New York, U.S.A.
 J. F. de Villers, L.D.S., P.O. Box 7668, Johannesburg, South Africa.
 R. Selmer-Olsen, Norges Tannlagehoskole, Oslo, Norway.
 A. Lundström, Stureplan, 19, Stockholm, Sweden.

Papers on "The Upper Respiratory Musculature and Orthodontics" were presented by C. F. Ballard, L.R.C.P. Lond., M.R.C.S., L.D.S.Eng., and E. Gwynne-Evans, M.B., B.S.Lond.

ANNUAL GENERAL MEETING

Monday, December 1st, 1947.

The Annual General Meeting of the Society was held at Manson House, Portland Place, W.1, on Monday, December 1st, 1947, with **Mr. Robert Cutler**, President, in the Chair.

The Minutes of the last Annual General Meeting were read and those of the last Ordinary Meeting taken as read and confirmed.

New members were introduced to the President.

The President announced that no private nominations for Officers and Council had been received, and therefore those whose names were on the Council's list were elected.

Mr. Ballard and Mr. T. L. Winn were elected Auditors, and the retiring auditors, Mr. Boness and Mr. Newton, were thanked for their long and able services.

Hon. Treasurer's Report.

The most important item of financial interest is the raising of the subscription for 1948 to £2 2 0. The necessity for this is revealed in the accounts since 1939. No subscription was charged for the years 1940, 1941 and 1942.

	Excess of Income over Expenditure.			Excess of Expend- iture over Income.		
	£	s.	d.	£	s.	d.
1939	72	17	10			
1940				54	0	5*
1941				16	8	1
1942				49	4	8
1943	61	3	3			
1944	132	1	4			
1945				82	6	11
1946				210	17	1
1947				394	7	9

For the five years since the subscription was re-imposed in 1943, the excess of expenditure over income was £494 7s. 2d. an average of approximately £100 per annum. For the last three years there has been an increasing excess of expenditure over income, the total being £687 11s. 9d. approximately £300 on account of 1947. (The 1947 accounts show £400 but £100 of this is on account of previous years.)

**This balance has been adjusted, as it included:—Subscriptions refunded, £60 18s. 0d. Purchase of 2½% Consols, £125 6s. 0d.*

The chief item of expenditure throughout is for the Transactions ; these have not been paid for since 1943, leaving the last 4 years unpaid ; their cost has to be estimated. Provision has been made for this, as follows :—

	Amount charged in Accounts.
Year to 30th Sept. 1946, 2 vols. 1944/45 and 1946	£300
Year to 30th Sept. 1947, 1 vol. 1947 £300, and £100 on account of the above vols. ..	£400
Total Reserve for 1944/5, 1946, 1947 Trans- actions (3 vols.)	£700
	—

The figure of £300 is for 2 volumes which is likely to be exceeded, so a further £100 has been provided in this year's accounts for them in addition to the £300 provided for the 1947 Transactions.

The accounts for 1947 show an excess of expenditure over income of £394 7s. 9d. but taking £100 from this amount as belonging to the 1946 Transactions, we are left with a deficit of £294 approximately equal to 17/6d. per member. All costs have risen and are rising, so the increased subscription will do little more than enable income and expenditure to balance ; in fact, there is a possibility that this may not be realized : if costs rise further, expenditure may easily overtake income again.

Provision has thus been made for the Transactions to date ; until last year this had not been done ; before the last war income was well in excess of expenditure so there was not the necessity for this as there is today, when it is doubtful if the increased subscription will suffice for the annual expenditure.

It will be seen that the Bank Balance of £721 is approximately the same as the estimated costs of Transactions and other creditors. This large balance is partly the result of realization of 500 National Savings Certificates, 3rd issue for £780 4s. 2d., only £375 of which has been reinvested by the purchase of 500 Certificates of the 7th issue.

It had been thought wise to institute an item “ Depreciation ” for furniture, etc.

Mr. President said that Mr. Chapman had made the position very clear and had justified the increase of subscription. Printing and other costs were rising, and it was a question whether the Society could see the year through on the present subscription.

On the proposition of Mr. Chapman, seconded by Miss Clinch, the Treasurer's Report was adopted.

Secretary's Report.

The Acting Secretary (Mr. Taylor) said that during the year the Society had held eight Ordinary Meetings, the average attendance being 80, compared with an average attendance of 58 last year. There had been an increase in membership from 251 to 324. Twelve meetings of the Council had been held, and, apart from the usual business, the publication of the Society's Transactions had received unremitting attention, and satisfactory arrangements had been completed. The Society's finances had also received full consideration.

The Society had sustained grave losses during the year particularly in the death of Sir Norman Bennett. The Honorary Secretary (Mr. Pringle) would return in a few days from an orthodontic visit to North America, and arrangements had been made to relieve him from some secretarial work, which had increased enormously during recent years.

On the motion of the President, the report was adopted.

Editor's Report.

The Editor said *The Dental Record* had published the Transactions since the inception of the Society in 1907. No agreement had been made between the Dental Mfg. Co. Ltd., the proprietors of the *Dental Record*, and the Society. Until the war years no great difficulties had been experienced. *The Dental Record* in its long association with the Society had given valuable help and this had been greatly appreciated. The Dental Mfg. Co. Ltd. had severed its association with *The Dental Record* which had been taken over by a private company of which Mr. L. G. Godden is editor and a director. The Council had met Mr. Godden and his co-directors regarding the continued publication of the Society's papers in *The Dental Record* and of publication of the Transactions.

The Council had entered into negotiations with the proprietors of the new *Dental Record* regarding the continuation of this journal as the official journal of the Society and for their publishing of the Transactions. The Company agreed to publish as many of the Society's papers as possible together with an abridged report of a discussion of a particular paper of general interest. The Company were also prepared to print the Transactions on the lines of previous years, and to guarantee responsibility for their publication within three months of receipt of complete material. The cost to be £250 for 350 copies, plus half cost of blocks, and provided that 50% of B.S.S.O. papers were published in *The Dental Record*. It had been further agreed that the Editor of *The Dental Record* should have the right to accept or refuse to publish papers given by members of the Society. In this connection since the present editor had been in office there had been only one refusal to publish a paper of the Society.

Now that the Society had an arrangement with the new *Dental Record* the Council hoped that a considerable number of members would become subscribers to this Journal. At present only about

40 B.S.S.O. members were subscribers. The welfare of the *Record* was now of some concern to the Society because the greater its circulation the better chance it had of survival as a good scientific journal.

The 1944/5 Transactions were being completed by printers who printed the *Record* up to 1945. The proofs of these Transactions had been read and after the printers had made corrections they would be ready for binding. Unfortunately, they were not likely to be ready until the end of March. The printing of the 1946 Transactions had been placed with the new Dental Record Company and were now in print. Proofs would soon be delivered. Binding would take about three months so that the Transactions for 1944/5 and 1946 would be delivered at about the same time. Those for 1947 would be ready in mid-1948.

The lay-out of the Transactions would be similar to those of other years with addition for 1946 and onwards of an index, added for the convenience of members.

The Council reiterated its regret at the delay in completing the Transactions. Everything possible had been done to speed up the printing but present problems had made the task extremely difficult.

The President said that the Council thought it was due to the members, who had borne in a most patient manner with the delay in issuing the Transactions, that the position should be made clear at that meeting by means of a statement from the Editor. The question of an independent journal had been fully gone into. The expense of such a departure was too great for the Society at the present time, but this was something to which they might return later. The new *Dental Record* group had given them assurances that they would do their best for the Society, and they in return had asked—and it was a reasonable request—that the members of the Society should give them as much support as possible. Members were therefore recommended to support the new *Dental Record*. In addition it would offer the advantage of early publication of papers, apart from any other intrinsic interest the periodical might have.

On the proposition of the President, the Editor's report was adopted.

Honorary Librarian's Report.

Gifts of books had been : *Orthodontische Fortbildung* by Prof. Hotz ; *Fauchard's Surgeon Dentist* by Lilian Lindsay, both presented by the authors. Mr. Harold Chapman had also made a gift of periodicals.

This had been the busiest year so far. Over fifty transactions had taken place ; every borrower had returned the books and periodicals in good time.

The last library catalogue had been issued in 1928 and it had been hoped to have a new and fuller catalogue in print by now but this had not been possible.

It had been impossible to get new American text books but the library subscribed to the *Journal of the American Dental Association*, *The American Journal of Orthodontics* and *The Angle Orthodontist*.

The library was housed with the museum in the Institute of Public Health and Hygiene and was available for the loan of books and periodicals.

Curator's Report.

There had been 26 additions to the Museum this year including models from Mr. C. A. Tinn of abnormal vertical relationship in the incisor area in twins, abnormal vertical relationship in the deciduous molar area in twins, and unilateral lingual occlusion of the upper deciduous molars in identical twins : also a case of asymmetry of upper incisors. Mr. Bragg had presented a case of misplacement of teeth in identical twins ; Wing Commander H. M. J. Williams, a case of retained deciduous teeth, and Mr. C. W. Harrison, a case with absence of lower central incisors. Professor Friel had given the illustrations of his paper on " Malocclusion in a 'Famous Horse'," read to the Society in 1938. Models and X-rays of cases with congenital absence of teeth, models of malocclusion caused by an abnormal frænum and models showing an excessive number of teeth had also been added.

A collection of photographs of past presidents of the Society was being made. Twenty-three out of thirty had been procured.

The members were urged to send models of unusual or interesting cases. Serial models particularly were useful—they now had a series from 3 years to 34 years, another from 3 years to 21 years and the series presented by Dr. Northcroft of face masks and models from 3 to 21 years. There was also an early case—from birth to 5 years presented by Dr. Sillman. Cases showing the results of early loss of deciduous teeth should not be hard to find and it would be gratifying if members would present some. If members would send, with the models, particulars of the sex, age and history (if possible), of each case, also X-rays if relevant.

There were now the serial models and all cases of variations and modifications of the positions of the teeth in man labelled with a description of the condition and all the available history. Some of the other specimens were also labelled and soon this should be complete. Unfortunately some of the old models were not marked at all and many were useless for this reason. When the labelling was complete, a catalogue of the entire contents of the Museum would be made.

The contents of the Museum could be seen at 25 Portland Place (The Royal Society of Public Health and Hygiene), between 9.30 and 5.0 on weekdays. Should members wish to see any particular specimen the Curator would be glad to show these at a Meeting of the Society.

ELECTIONS.

The President said that the Council recommended the election of Mr. Warwick James as Honorary Member. Mr. James had had a long and distinguished career in dentistry and had been a member of the Society for very many years. He had now virtually retired from practice, and it was thought that it would be a pleasant compliment to offer him the Honorary Membership.

The recommendation was agreed to unanimously.

Miss Lorna M. J. Ewart, of Chester, was elected an Ordinary Member.



THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

INCOME AND EXPENDITURE ACCOUNT for the Year ended 30th September, 1947.

1946			1946			1946			1946			1946		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
10	10	0	10	10	0	264	10	0	By Members' Subscriptions	..	..	328	13	0
—	—	—	19	10	6	8	8	0	„ Sales of Transactions	..	..	7	7	0
46	4	8	£81	15	11	16	6	1	„ Interest on Investment	..	..	17	5	4
300	0	0	400	0	0	210	17	1	„ Excess of Expenditure over year to date	..	..	394	7	9
11	5	11	..	..	..	481	15	11						
10	10	0	..	..	..	23	7	8						
45	0	0	48	3	0									
31	10	0	42	0	0									
29	5	9	52	18	4									
3	16	4	4	16	6									
—	—	—	Telephone and Telegrams	..	..	154	12	10						
3	9	2	Travelling Expenses	..	..	1	10	3						
5	5	0	Audit and Accountancy	..	..	5	5	0						
1	2	6	Insurance	..	..	3	4	3						
—	—	—	Photographs of Presidents	..	..	5	18	0						
—	—	—	Presentation—Mrs. Taylor	..	..	5	5	0						
—	—	—	B.D.A. Benevolent Fund—	..	..							
—	—	—	In Memoriam, Sir Norman Bennett	..	..	2	2	0						
1	7	6	Journal—A.D.A.	..	..	2	8	0						
14	4	—	Sundries	..	..	1	3	2						
—	—	—	Depreciation—Furniture and Office Equipment	..	..	30	11	6						
£500	1	2				£747	13	1				£747	13	1
£500	1	2				£500	1	2				£747	13	1

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

BALANCE SHEET as at 30th September, 1947.

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